VOLUME XI February, 1924 NUMBER 2

[FOUNDED IN 1906 AS THE AMERICAN QUARTERLY OF ROENTGENOLOGY]

THE AMERICAN JOURNAL OF ROENTGENOLOGY AND RADIUM THERAPY

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67-69 EAST 59TH STREET · NEW YORK, N. Y.

THE AMERICAN ROENTGEN RAY SOCIETY—*Twenty-fifth Annual Meeting*, To be Announced
CENTRAL SECTION—*Fifth Annual Meeting*, Indianapolis, February 23, 1924
THE AMERICAN RADIUM SOCIETY—*Ninth Annual Meeting*, Chicago, June 9-10, 1924

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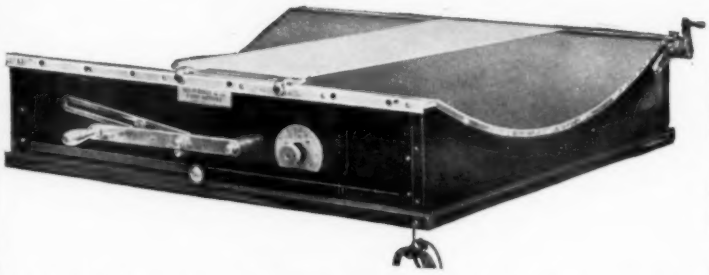

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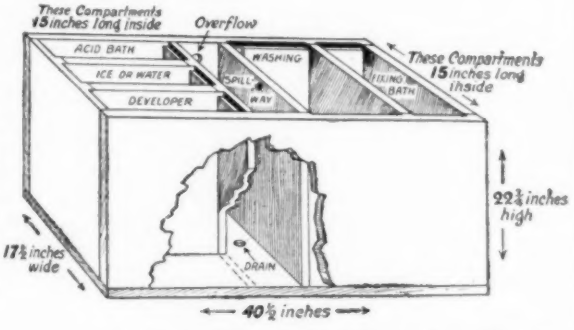

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THE AMERICAN JOURNAL OF ROENTGENOLOGY AND RADIUM THERAPY

VOL. XI FEBRUARY 1924 No. 2

CANCER THERAPY FROM THE SURGEON'S STANDPOINT*

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INTRODUCTION

WE are accustomed to regard the roentgenologist and the radium therapist as aids to the surgeon. If the advances in roentgen and radium therapy continue at the pace at which they have been demonstrated at this meeting, I think we will have to call the surgeon an aid to the radiologist.

When we look back some twenty-five years and then note the resources that we have today in treating cancer, we must, even the most pessimistic of us, admit that we are very much nearer to the solution of the problem than ever before. The only drawback that I can see is that we do not discover how to *prevent* cancer. Although some statistics seem to prove that cancer is on the decrease, it is almost certain that it is still on the increase. I believe the solution of the problem will probably come from some source other than surgery or radiology, and that in the near future we will have human immunization of the body against cancer by serums or possibly through eugenics.

The main difficulty apparent in the discussion on cancer, is the fact that we are not able without material injury to the neighboring normal tissues, to deliver into the cancer field a sufficient dose of roentgen or radium rays to destroy every cancer cell. The problem which I think should be dealt with is not so much that of adjusting the proper dose, as that of making it possible to use very much smaller dosage of rays to accomplish the same result.

We have in the body two kinds of tissues, the "stationary" and the "circulating" tissues. When the rays are concentrated on one small area of a patient's body, practically all the blood in his body is exposed to the radiation because the blood contained in the tumor at one time circulates through the body, and each time it passes through the radiated area, to which it is exposed.

The reason why superficial tumors and growths respond quickly to radiation, is that it is possible to apply the radioactive substance directly into the growth itself without material injury to the rest of the body. In deep-seated tumors the problem is different. The overlying tissues must be penetrated by the rays before the seat of the trouble can be reached, and thus the dosage must be much larger.

In order to solve this problem, I have for years advocated the removal of the overlying tissues and as much of the tumors as possible, and then the introduction of the radioactive substance, either radium or roentgen rays, directly into the tumor mass. This method accomplishes two objects; viz., it prevents

* Read at the Twenty-fourth Annual Meeting of THE AMERICAN ROENTGEN RAY SOCIETY, Chicago, Ill., Sept. 18–21, 1923.

general infection and toxemia. If a tumor is locked within the body, it must be liquefied before it can be eliminated. It cannot be absorbed into the circulation and then eliminated through the excretory organs until every cell has been broken down.

THE APPARENTLY HOPELESS RECURRENT CARCINOMA AND SARCOMA: WHAT CAN BE DONE FOR THEM?

The various phases of this question are discussed under the following heads:

1. The necessity of cooperation of surgeon and radiologist.
2. Why the deep-seated carcinoma does not yield as readily to radium and roentgen-ray treatment as the superficial.
3. Transformation of deep-seated tumors into superficial ones, preparatory to radiotherapy.
4. Morphologic and biologic changes of normal and cancer cells after radiation.
   (*a*) Stimulation of growth.
   (*b*) Sterilization of cells.
   (*c*) Necrosis of cells.
5. Theory of relative radio-sensibility of normal and cancer cells.

Let us first define what is meant by "apparently hopeless." The combination of the two words seems a contradiction. If something is hopeless, there should be no "apparent" attached to it. However, the fact that we often find surprising improvement in hopeless cases leads us to be guarded in pronouncing a case *entirely* hopeless.

I have come to the conclusion that surgeons are entirely too pessimistic; that we have not yet exhausted all our efforts and that in the apparently hopeless cases, more may be done. With this attitude, I desire to make a few suggestions.

I shall confine myself to the advanced cases in which surgical operation is inadvisable or in which one or more surgical operations had been performed, and recurrence had taken place. In choosing such material for our work, we must not become discouraged. We cannot expect the impossible. Neither must we enter upon this work in a half-hearted way. If we do, we are apt to fail in doing our best. We enjoy other advantages in choosing this class of cases in that we obtain cooperation with our patients, and if we fail we are not likely to be reproached. If we succeed in only a few cases, we shall have accomplished something.

1. *The necessity of cooperation of surgeon and radiologist.*

The pessimistic attitude toward cancer therapy is gradually diminishing. This is due mainly to the acquisition of a helpful ally to surgery, namely, radiotherapy.

It is only within the past five years that the use of radium and the roentgen ray have found any respectable recognition in the treatment of malignant growths. Previous to this their value was doubted, and the favorable reports of radiologists were met with suspicion, and even treated with scorn. This was quite natural, because there were only a few men in the country who were competent to apply these agents with precision. Many applied them regardless of dosage and with indifference as to the scientific methods of directing the rays into the field required. Therefore, the results were only temporary, and the constant recurrences in reported cures were a great disappointment to the hopes of surgeons and the public. In the meantime, radiologists of note have made important improvements in technique and thus have brought these remedial agents into recognition. Many a skeptical surgeon has now become an enthusiast. One is impressed with the increase of contributions in radiology when he compares the recent programs of the medical conventions with those of five years ago.

A review of the non-operable methods of treatment of inoperable carcinoma, issued by my brother, Dr. Joseph C. Beck, in the December, 1912, number of the *Index of Oto-Laryngology*, cited the following methods that had been employed since 1895:

1. Bacteriotherapy
   (*a*) Bacterial products.
   (*b*) Immunizing process.
2. Chemotherapy
   (*a*) Arsenic-atoxyl, salvarsan, arsacetin.

(*b*) Kankroin.
(*c*) Antituman.
(*d*) Quinine, formalin, resorcin, kolargol.
(*e*) Metals.
(*f*) Cholin.

3. Physical Means
(*a*) *X*-rays.
(*b*) Radioactive substances, as radium, mesothorium, thorium X.
(*c*) Fulguration.
(*d*) Diathermia or desiccation.
(*e*) Electrolysis, Finsen light, heliotherapy, carbon dioxide snow.

4. Miscellaneous Agents
(*a*) Pharmocological substances.
(*b*) Organotherapy.
(*c*) Ferments and anti-ferments.
(*d*) Circulatory destruction.

None of these, with the exception of the roentgen ray and the radioactive substances, has stood the test of time, and today practically all of them have been given up as inefficient. One of these methods, however, has not yet had a sufficient trial, namely, the immunizing serums. It is quite possible that in the future, experimental work will lead to immunization against cancer growth.

Surgery and radiotherapy dominate today the field of cancer work, and for these two alone shall I speak in this paper.

The surgeon of today may well speak with authority on the cancer question. He has had the benefit of generations of experience. His slogan is: "*Operate early and radically*, or you render no service to your patient."

Radiology is not a competitor of surgery. Its claims are modest enough when we consider what it has already contributed to cancer therapy. Roentgenologists are greatly handicapped, however, because surgeons do not collaborate sufficiently with them. How much more efficacious this treatment would be, if both surgeon and roentgenologist were to correlate their work, and work hand in hand.

In former times the surgeon referred to the roentgenologist only those cases for which he believed surgery could do nothing further. He advised radium and the roentgen ray merely as a means of satisfying the unfortunate individual and making him believe that something was being done for him.

Today the attitude is changed. The surgeons expect more of the roentgenologists. They now decide that in certain cases radiotherapy is preferable to surgery. In many large clinics, carcinoma of the cervix is now treated with radium instead of surgery. The same is true of carcinoma of the prostate, while postoperative roentgen treatment is gradually being adopted by the most conservative surgeons in the country.

2. *Why does the deep-seated carcinoma not yield so readily to radium and roentgen-ray treatment as the superficial.*

The literature supplies us with sufficient evidence of the fact that superficial malignant growths such as epitheliomata may be eradicated by either the roentgen ray or radium when no metastases are present or when lymphatic glands are not involved.

Quite different is our experience with deep-seated cancers. When the radioactive substances can be placed in close proximity to or in contact with the growth itself, the results are more encouraging: but in cases, for instance, of carcinoma of the pancreas, the liver, or the stomach, the results have thus far been unsatisfactory. There are a number of reasons for this, the principal one of which is that the overlying structures, such as the skin, the fat, the muscles and the bones, act as barriers to the penetration of the rays. This has been verified by experiments. In October, 1919, I published some experimental work on this subject which proved the above-stated fact.

Radium, as well as the roentgen rays, produces rays of various wave-lengths and consequently of varying penetrating power. The hard rays are the more penetrating. Radium emits three varieties of rays, the *alpha*, the *beta*, and the *gamma*. The *alpha* rays constitute about 91 per cent, the *beta* about 7 per cent, and the *gamma* only 2 per cent. The *alpha* rays cannot be considered in radiotherapy since they are absorbed in the glass receptacle in which the radium is enclosed. Rutherford states that $\frac{6}{1000}$ in. of aluminum or a sheet of thin writing paper will absorb all the

alpha rays. The beta rays are about one hundred times more penetrating than the alpha, and nearly all will be absorbed by 5 mm. of aluminum or 1 mm. of lead. These rays are useful in radiotherapy, and their action may be controlled by proper screening. The gamma rays are from ten to one hundred times as penetrating as the beta rays; these are the rays that play the most important part in radiotherapy. The knowledge of the penetrating power of these three varieties of rays is a practical guide in the proper application of radium.

The thickness of matter required to absorb a certain quantity of rays is inversely proportional to its density. It requires, for instance, 20 mm. of aluminum to absorb as many rays as 1 mm. of brass. The same rule applies to living tissues. Skin will filter more rays than fat, and bone more rays than skin. Roentgen-ray shadows produced on photographic plates by different substances of equal thickness give us an approximate index as to their density. The density of any substance depends upon the close packing of the molecules of which it is composed. Metals, such as gold, have a greater density than wood or flesh, because the gold molecules are packed more closely.

The essential requirements for a favorable result lie in the ability to deliver into the cancer a dosage of rays sufficient to destroy the life of each and every cancer cell without material injury to the adjacent normal body cells. In other words, we must define the topographical dimensions of the growth and project into this field a quantity of rays which must be no larger and no smaller than is required for cancer-cell destruction. Too large a quantity of rays will no doubt destroy the cancer cell, but it will at the same time injure normal cells adjacent to the cancer field to such a degree as to pave the way for more extensive cancer invasion.

In order to accomplish this difficult task, we must calculate our dosage not merely by the output of the machinery or the milligram hours, but by correct deduction of factors which increase or diminish the dosage actually reaching the seat of the disease.

If the growth be deep-seated and covered with a thick layer of tissues, such as the skin, fat and muscle, a large percentage of rays will be absorbed by these structures. To this loss of radiation we must add another loss—that caused by the artificial filter which it is necessary to place upon the skin in order to prevent burns. If the operator interposes 1 mm. of lead and a layer of leather to protect the skin, the lead alone will absorb 99½ per cent of the beta rays and about 7 per cent of the gamma rays. At times the operator also interposes what is called a distance block, a small block of wood or other light material upon which he fastens the radium capsule, to keep it at a distance from the skin. This procedure adds still another loss of radiation.

These combined losses of radiation due to artificial filters, the intervening tissues and the distance block, reduce the efficiency of the radioactive substance considerably. A far greater loss, however, is occasioned by the dispersion of the rays from the radium capsule in all directions, when it is placed on the surface of the body. Only that cone of the rays which passes toward the body, is then utilized, and the rays which pass laterally upward are lost. If the same quantity of radium were placed in the center of the growth, all these combined losses of radiation would be avoided. A given amount of radium placed within the growth will produce an amount of active radiation many times as great as when placed on the surface of the skin at some distance from the tumor.

To make this clearer, I illustrate this principle by two sketches of a chest with a centrally located tumor (Figs. 1 and 2).

Figure 1 indicates that the radium is placed on the surface of the body, and Figure 2 that it is in the center of the tumor. One can see at a glance the difference in action of the radium in the two instances.

For convenience, we have divided the entire sphere into sixteen cones of equal size; each cone, therefore, represents $\frac{1}{16}$ of the output of the radium emanation. We must consider, however, that this estimates only the rays emanating in one plane. To calculate more correctly, we must take into account the rays which emanate laterally from the radium.

In Figure 1, where the radium is placed on the surface of the body, only two cones, Nos. 9 and 10, reach the tumor; the remainder of the cones are dispersed in other directions. We note, also, that only the gamma rays reach the tumor—the beta rays have been absorbed by a screen of 2 mm. of lead and the overlying tissues, and have heretofore been entirely useless in this application.

Comparing this with Figure 2 where the radium is placed directly in the tumor mass, we find that all sixteen cones are projecting their rays into the tumor itself, and that the beta rays, which are most useful, are fully utilized.

It is thus evident that when treating deep-seated carcinoma through overlying tissues, we are obliged to use much larger quantities of radium in order to deliver into the tumor itself sufficient dosage. By placing the radium directly in the cancer bed much smaller doses are sufficient. By reducing the quantity of radium, the normal structures will be spared, with consequent reduction of the danger of producing toxemia.

The following factors are to be taken into account in the correct application of radium:

1. Placing the radium at a distance from the growth diminishes the activity.
2. Placing artificial screening of lead or leather over the skin filters out the most effective rays.
3. A further reduction of activity of the rays is produced by an additional absorption of rays by the skin and underlying tissues.
4. Only a small percentage of the radiation enters the field to be treated; the remainder is lost by scattering in other directions.

3. *Transformation of deep-seated tumors into superficial ones preparatory to radiotherapy.*

Having come to the conclusion that the deep-seated carcinoma is resistant to radiotherapy because of the difficulty of delivering a sufficient quantity of rays into the seat of the disease without undue injury to the rest of the body, I have attempted to solve the problem by converting the deep-seated carcinoma into a superficial one—in other words, to expose the tumor to direct radiation. This requires of course, a surgical operation.

Such surgical procedures must often of necessity be very extensive and, therefore, must be attended with some risk. A halfway procedure is useless in such cases. It was a surprise to us, however, to find that the immediate mortality was not so large as one would expect. It is

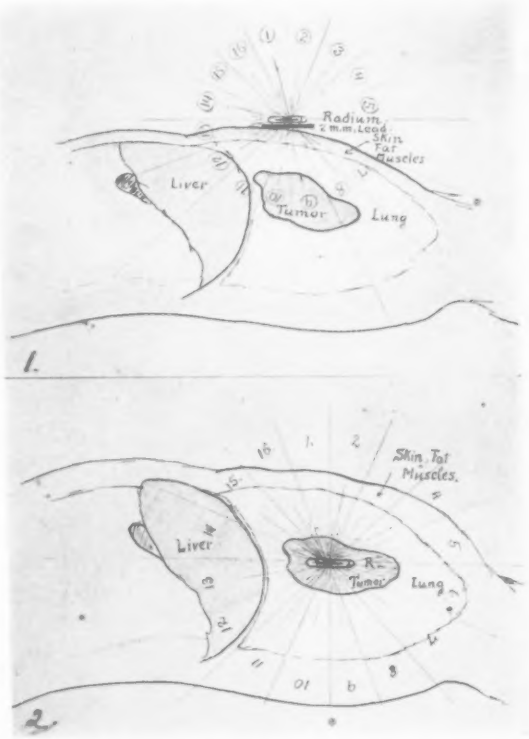

FIG. 1. Illustrates the small number of cones penetrating the tumor when radium is placed on the skin.
FIG. 2. Illustrates the difference in distribution of rays when radium is placed within the seat of the tumor.

not necessary to describe the technique, because this varies in each case and the illustrations which accompany the case reports give sufficient information. If the principle appeals to the trained surgeon he will be able to devise his own plan in each case. The principle of the surgical procedure is as follows: *We remove the skin and fat, the muscles and other overlying tissues, and as much of the growth as is safe or possible.*

At times it is possible to remove the tumor entirely, leaving a perfectly clean

field with no visible remnants of the growth. At other times it is possible to remove only a part of the growth, because it is attached to or embedded in vital organs. No attempt should be made to diminish the size of the wound by sutures. The wound is left open for subsequent applications of either roentgen ray or radium, as the case may require. This procedure practically converts a deep-seated growth into a superficial one, which is therefore favorable for treatment. With this large area widely open, we may now apply either the roentgen rays or radium placed directly in the bed of the disease. It becomes unnecessary to do any material screening, especially when there are thick layer of the disease tissue left, because we have by this procedure eliminated the danger of skin burns and may with safety place radium in direct contact with the tissues which we wish to destroy. Screening becomes necessary only when we have exposed large blood vessels, vital organs, or nerves. These must be protected during radiation. The dosage of radiation employed may now be reduced to a fraction of the quantity which would have been required had the application been made through the skin, for reasons already mentioned.

This method of combined treatment, namely, the removal of overlying tissue and the direct applicationof the radioactive substances, has now been carried out in a variety of cases, sufficient in number to support certain conclusions. For illustration, we shall cite a few from a series of more than 100 cases. In each case here illustrated, will be brought out some point of information relative to the appliance of this method.

FIG. 3. Wound left open after resection of cancer of the breast for subsequent radiation.

FIG. 4. Healing of wound without secondary sutures (scar movable).

TECHNIQUE EMPLOYED IN PRIMARY CARCINOMA OF THE BREAST

Figure 3 illustrates the open wound after the resection of the right breast and the axillary glands. The vessels in the axilla were protected by a few sutures of the upper flap, but the radium was inserted underneath this flap subsequent to the operation. As a rule we do not put in any sutures in the lower end of the wound; we leave a much larger area exposed than is

shown in this case. Figure 4 shows the same case as it appeared two years after the operation. The wound is contracted, the scar tissue is not adherent to the chest wall and can be lifted up just the same as the normal skin.

Comment: This technique has been carried out in primary resections of carcinoma of the breast only; in cases of recurrence the operation is much more radical. I desire to illustrate the procedure in such a case.

PROCEDURE IN RECURRENT CASES

Female, admitted to the hospital October 25, 1921, with a recurrent carcinoma of the breast. She had been operated upon about a year previously.

Her physical condition was good. In the line of incision of the breast wound were a large number of nodules. The axilla was filled with recurrent carcinoma, adherent to the chest wall. The lungs were not involved.

The operative procedure in this case is illustrated in Figure 5, which shows the complete resection of the pectoral muscles, with clearing out of the axilla to the lower border of the clavicle. This large space was left entirely open for subsequent treatment with roentgen ray and radium. For several weeks the wound continued to retract and there was no evidence of recurrence. This is shown in Figure 6. The final result of this case, however, was unfortunate—the patient died from recurrence about a year later.

FIG. 5. Radical procedure in secondary operation after recurrence in the axillary space. Wound left open.

FIG. 6. Gradual regeneration of skin and contracture (without suture). Three weeks after operation.

CARCINOMA OF THE BREAST—METASTASES IN THE PELVIS DESTROYING THE RIGHT RAMUS OF PUBIS—RESTORATION OF THE BONE AFTER RADIATION

This case is exceedingly interesting because of the complete regeneration of 2 in. of the pelvic rim subsequent to the disappearance of the tumor in the pelvis.

The patient is aged forty-two, married fifteen years, has had four children, normally delivered, without forceps. Injury to the pelvis during childbirth is excluded. She has had three miscarriages. In November, 1922, she came into the hospital complaining of a tumor in the left breast, which in the past year had grown to the size of a fist. Her second complaint was pain in the right hip. She walked with a limp, and during the last month she has been hardly able to walk at all.

Examination of the chest revealed a typical carcinoma of the breast with involvement of the axillary glands.

The pelvis contained a tumor mass in the right iliac fossa, not movable—adherent to the pelvic bone. This was evidently a metastatic carcinoma. A roentgenogram of the pelvis shows distinctly an absorption of

the right ramus of the pelvic bone (Fig. 8). This extraordinary finding was corroborated by repeated roentgenograms.

The patient was advised to have a radical operation for the breast carcinoma, but to depend upon roentgen treatment for the pelvic tumor, because this was considered inoperable. On November 7, 1922, the breast was radically removed, the axillary glands being completely eradicated, and the wound left *entirely open* for

FIG. 7. Patient one year after operation, scar movable; no recurrence in breast nor pelvis.

subsequent radium and roentgen treatment. The roentgen treatment for the pelvic condition was carried out in the Radiological Department of the North Chicago Hospital under the direction of Benjamin H. Orndoff, M.D. The report of dosage given by him is as follows:

"The *x*-ray treatment was divided and administered in three series. The duration of each series was five days. The second and third series were administered after an interval of four weeks. The technique was: voltage, 200 kv.; filter, 0.75 mm. cu. plus 1 mm. Al.; skin-anode distance, 50 cm.; portals, 20 × 20 cm.; milliampere minutes, 480 per portal, during each series. Three portals were used, one anterior and two postero-lateral. Epilation occurred following the first series. Marked tanning followed the second series, and there was considerable scaling and some painful erythema following the third series. Eight weeks later there was some evidence of subcutaneous fibrosis, more marked on the posterior portals. The patient developed *x*-ray sickness following the first series, which lasted for a few days. Practically no further undesirable symptoms were noted during the treatment."

At the present time (nearly a year later) there is no recurrence, either in the breast or in the pelvis. The wound in the breast is now entirely covered by skin, as shown in Figure 7. While the patient has not yet regained her former state of health, she is able to walk without the limp, has no pain in the pelvis nor in the hip, and has perfect motion in the hip joint.

Roentgenological Check-up on Changes of the Bony Pelvis. In comparing the roentgenograms of the pelvis taken before and after deep therapy, we find quite a surprising change. Figure 8 represents the condition before the treatment was instituted. It shows distinctly that the ramus of the pubis on the right side had been destroyed by the growth. Comparing this now with Figure 9, which was taken ten months later, subsequent to deep therapy, we notice a complete restoration of the ramus of the pubis, and so perfect is the regeneration of the bone that there is scarcely any difference between the left and the right side.

A similar case was reported by Dr. George E. Pfahler in August, 1922, in which a second lumbar vertebra, destroyed by metastatic carcinoma, was recalcified by the influence of the roentgen treatment. This regeneration of bone subsequent to roentgen treatment is positive indication that carcinoma cells do not exist in this particular field.

OSTEOCHONDROSARCOMA OF THE RIGHT CHEST CAVITY AND WALL

Case Report. Male, aged sixty-five, was referred with the following history: A few years ago the patient had a slight automobile accident. Soon after a small cartilaginous tumor appeared between the

ribs and the sternum. A year later the tumor began to degenerate, and grew to such an extent that it bulged out of the upper part of the chest. An attempt was made at home to remove the tumor, but when it was found that it penetrated 4 to 5 in. into the chest cavity, the attempt at removal was abandoned. After this operation the tumor began to grow very rapidly.

roentgenogram (Fig. 13), gives a very clear picture of the depth and extent of the tumor, showing also that the first, second and third ribs are partly destroyed, as well as the upper half of the sternum and two-thirds of the clavicle. The tumor fills out the upper half of the right chest, displacing the lung downwards. The patient consented to a radical operation, which was done in two steps.

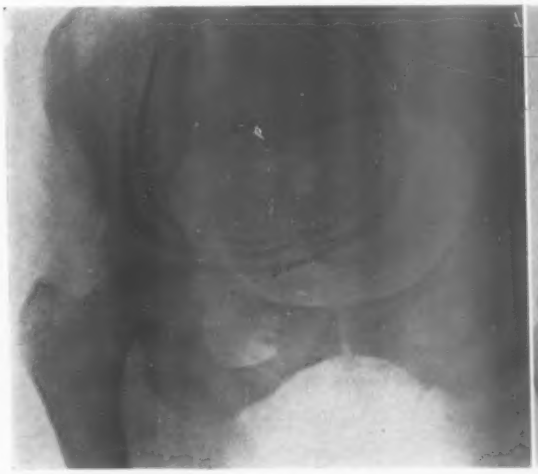

FIG. 8. Roentgenogram of pelvis showing destruction of ramus of the pubis (metastatic carcinoma).

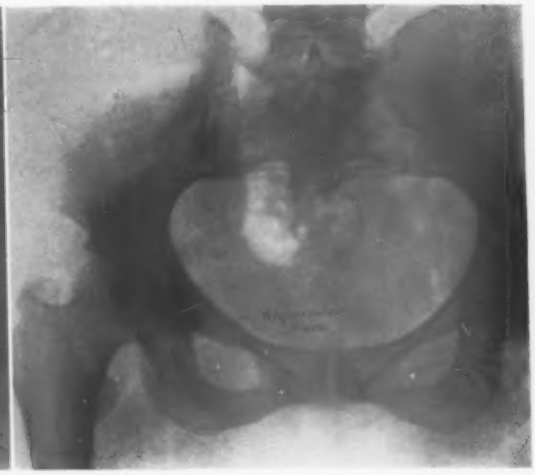

FIG. 9. Same as Figure 8, ten months later; ramus of pubis regenerated (subsequent to deep therapy).

FIG. 10. Osteochondrosarcoma involving chest wall and one half of right chest cavity.

FIG. 11. Removal of first, second and third ribs—clavicle, sternum and the tumor (wound left open).

FIG. 12. Gradual contracture of the wound following radium treatment. Re-expansion of the lung.

The patient was seen by me on April 20, 1923. Figure 10 gives a good idea of the extent of the tumor. It involves the clavicle, sternum and several ribs. The

First operation: May 8, 1923, the second and third ribs, the sternum, and as much of the tumor as was possible, were removed.

Second operation: Two days later the operation was completed by resection of the clavicle and the first rib. Fortunately, the subclavian artery and vein were not injured in this operation, although they were in proximity to the growth. This operation produced a very large open wound, extending from the right axilla to the left edge of the sternum and from the neck down to approximately the fifth rib. The cavity was very deep, because the greater part of the tumor had been enucleated as shown in Figure 11.

Roentgen treatment was not employed in this case.

The wound began to contract and skin regenerated rapidly from the edges so that at the present time the wound is only about one-fourth of its size at the time of operation (Fig. 12). The lung has evidently re-expanded, inasmuch as the granulating surface seems level with the chest wall, whereas in the beginning there was a deep cavity. This fact is fully illustrated in a roentgenogram (Fig. 14), taken six weeks after the operation. It not only

FIG. 13. Roentgenogram of chest showing size and location of tumor.

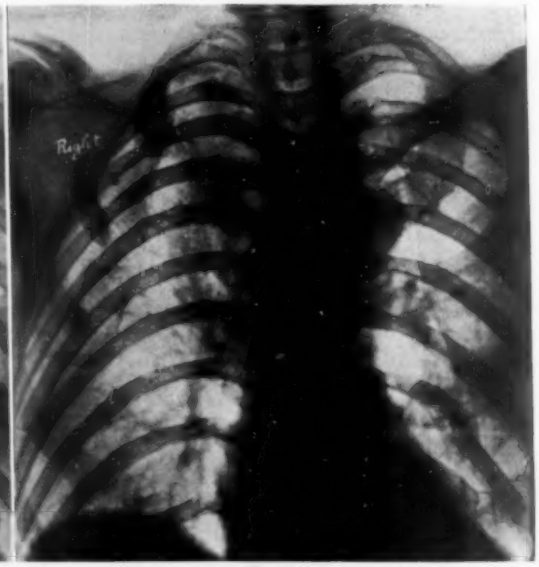

FIG. 14. Roentgenogram taken six weeks after operation showing absence of tumor. Lung re-expanded.

Three days later the first application of radium was made. Six needles, amounting to 150 mg., without screening, were placed in the depth of the tumor for 1,400 mg. hrs. There was no toxemia following this application. Since that time the application of radium has been as follows:

Date	Mgm.	Hrs.	Mgm. hrs.	Location
6/16/23	75	3	225	Placed in the depths of tissue to diminish the sloughing
7/ 5/23	50	4½	225	Depth
8/ 5/23	100	8	800	Superficial
8/ 7/23	12½	4	50	Depth
8/16/23	37½	6	225	Depth
8/23/23	200	7	1,400	Superficial
9/18/23	100	9	900	Superficial

shows that the tumor has been entirely eradicated, but that there is no recurrence. The entire chest cavity is now occupied by healthy lung.

The patient's general condition is satisfactory although thus far he has gained slowly. It is too early to state whether or not this will be a permanent cure, but the case is here illustrated for the purpose of showing our method of attack upon a condition which otherwise would be entirely hopeless.

4. *Morphologic and biologic changes of normal and cancer cells after radiation.*

(*a*) Stimulation of growth

(*b*) Sterilization of cells

(*c*) Death of cells

A thorough knowledge of the histological changes in the tissues produced by radia-

tion is not merely a matter of scientific interest, but also of extremely practical value. Indeed, it is the foundation of, and a necessity for, successful therapy. At first it appears a simple matter to obtain from the literature and one's own experience an up-to-date résumé of this subject, but as we begin to analyze the work of many investigators we meet with such a volume of special investigations that we can mention here only those facts which seem essential for practical purposes in this work.

NORMAL TISSUES

In the application of radium or roentgen ray, we must take into consideration the fact that the body consists of two kinds of tissues: First, the stationary, such as bones, muscles, secretory, excretory, and digestive organs, the connective tissues, etc.; and second, the migratory or circulatory tissues, such as the red cells, the leucocytes, lymphocytes, etc.

When radiation is concentrated upon a certain area in the body, the rays bombard the stationary tissues in this area but inasmuch as the blood stream flows through the radiated part, the cellular constituents of the blood receive a charge from the radiation as they pass through. It is thus evident that deep therapy affects the entire volume of blood in the body.

Normal body tissues are not equally affected by radiation. Some varieties are only slightly injured by radium or the roentgen ray, except when very large doses are applied. The cornea, for instance, is only slightly radiosensitive, and brain cells are spared when intracranial tumors are being successfully treated by radiotherapy.

Dr. Isaac Levin,[1] in his report on the action of radium on circulating blood of turtles and frogs, found that the lymphocytes are more radiosensitive than the leucocytes and the erythrocytes, and that radiation produces a release of polymorphonuclear leucocytes from the bone marrow, or an over-production of the same by the blood-forming organs.

This specific radiosensibility of lymphocytes explains the action of radium and roentgen rays on normal and diseased lymphoid tissue. The destruction of the lymphocytes in the lymphoid tissue is associated with endarteritic obliteration of blood vessels, resulting in the formation of dense connective tissue.

PATHOLOGIC TISSUES

Normal lymphoid tissue is less radiosensitive than the various types of hyperplasias and lymphomas. Tuberculous glands are less radiosensitive than neoplastic tissues. Hodgkin's disease is extremely radiosensitive. Enlarged spleen shrinks to normal size under radium and roentgen influence. Lymphosarcoma is influenced more promptly than any other form of lymphoid hyperplasia. Enlarged thymus and mediastinal tumors also yield readily.

The changes in carcinoma cells from radiation were studied by many investigators, especially by Haendly of Bonn.[1] He compared microscopic sections from the carcinoma rayed for three weeks with specimens of the same tumor which had not been rayed, and found that the rayed specimen contained small groups of carcinoma cells which were surrounded by connective tissue. Furthermore, the carcinoma cells in the rayed specimen were closely packed and the nuclei were much larger in proportion to the cell bodies. The individual cell was larger and flat, and on account of the large amount of protoplasm in each cell, the entire specimen seemed much paler. Under larger magnification it seemed edematous and did not take the stain uniformly. The nucleus of one cell took the stain very dark so as to obstruct the structure of the cell, while a number of finer other cells were full of vaculoes and stained faintly. Even the protoplasm varied in its intensity of staining, one cell being brighter than another. The outlines of the cells were rather sharp.

Karyokinetic changes were not frequent after radiation, but at times there was an increased proliferation. Further changes

[1] LEVIN, I. Action of radium and roentgen rays on normal and diseased lymphoid tissue. *J. Am. M. Ass.*, September, 1921, lxxvii, 930.

[1] HAENDLY. Strahlenwirkung mit Hinblick auf die sog. "elektive wirkung" Strahlentherapie, A. f. Guor., 1918, Bd. 109 S. 409.

took place in cases in which radiation was kept up for a long period. The carcinoma cell-groups began to diminish in size; the connective tissue increased, and in a great many of the cells there were fine black specks, something like dust, sprinkled throughout the cell body. This was, no doubt, due to the disintegration of the nuclei. In some instances the nucleus would become smaller and smaller until it finally disappeared and nothing but the protoplasm was left, which finally also disintegrated. Some of the cells, however, remained almost normal.

Dr. Joseph Beck and myself have been able to verify the findings of Haendly in

FIG. 15. Excision of supraclavicular glands. Wound left open for subsequent radium treatment.

several cases of carcinoma which had been radiated. I desire to cite a case in which these findings were vividly demonstrated. The case was first reported in October, 1919.

Female, aged forty-eight, a doctor, married; developed carcinoma of the left breast in June, 1918. In September, 1918, the breast was amputated, with radical removal of all glands below the clavicle. Roentgen treatment was given after the operation, but recurrence of carcinomatous glands above clavicle took place. I decided then to remove the skin, fat, and all cancerous involvement within reach above the clavicle. This was done on January 21, 1919. The clavicle was entirely exposed, and as much diseased tissue above the clavicle as was feasible was extirpated. The wound was left open (Fig. 15).

Through the open wound roentgen and radium treatments were applied. Within a few weeks the entire wound was covered with dry skin. The patient had been gaining weight at the rate of 1 to 2 lbs. a week since that time. Several months later I noticed a gland in the supraclavicular region about the size of a hazelnut. We were uncertain as to whether or not it was carcinomatous as the patient continued to gain. After this gland reached the size of a pecan nut, it stopped growing and remained stationary for one year. The patient's condition remained unchanged; she was able to keep up the strenuous work of her medical practice. In November, 1920, I demonstrated her before the Southern Medical Association, and called attention to this gland on her neck. I stated that I did not consider this gland malignant, although it might have contained cancer cells. This statement seems a contradiction. I mean by this that the cancer cells had lost their reproductive power through the influence of radium, and, although the cellular structures were not destroyed by the radium, they were sterilized and thus became benign in their character. The patient, upon return from this meeting, consented to an excision of this gland for microscopic examination. This was done in November, 1921, and two more glands of the same size were found deeper in the supraclavicular space. The examination of this gland again verified the characteristic findings of Haendly, and the microscopic section is herewith shown.

Low power. There is a great increase of the connective tissues surrounding cancer nests with breaking down of the cancer cells (Fig. 16), in some instances forming a homogeneous mass.

We note that there is an infiltration of the connective tissue surrounding the group of carcinoma cells, and a narrow space between the cancer nest proper and the connective tissue.

High power. The carcinoma cells themselves are typical, as described by Haendly, the nucleus is broken down, and the cell body looks as though pepper were scattered over it (Fig. 17).

STEREOSCOPIC MICROPHOTOGRAPHY

At this point I desire to mention the marked advantage I have obtained by studying the microscopic slides of these encapsulated cells by means of the *stereoscopic method*. By employing this method we obtain not only a true picture of the depth of the various layers of cells, but also a much clearer definition of the cellular as well as the fibrous structures.

I have succeeded in reproducing these stereo-micro-sections on paper so that they

may be studied by means of the parlor stereoscope. I desire to illustrate here the first stereo-microphotograph which I have been able so to reproduce (Fig. 18). If the reader will take the trouble to cut out this picture and view it through the stereoscope, he will behold a view entirely new to him. He will observe that the whole specimen resembles a transparent slice of a certain thickness of tissue composed of several strata of various cellular or fibrous elements in their relation to one another.

In this particular specimen we find a number of small sacks within the interior of which are packed a large number of cells. These cells are the carcinomatous remnants which have been incarcerated by connective tissue growing around groups of cancer cells, undoubtedly Nature's effort to exterminate them or to keep them from reproduction. The stroma in which these sacks are embedded is a reticulum of connective tissue which has replaced the carcinomatous cells.

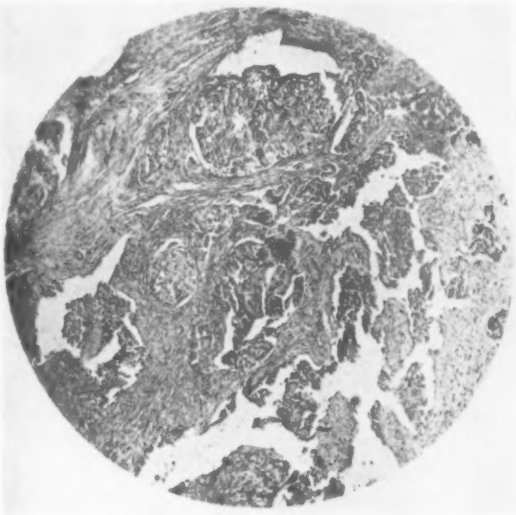

FIG. 16. Microscopic section of the supraclavicular glands after radiation.

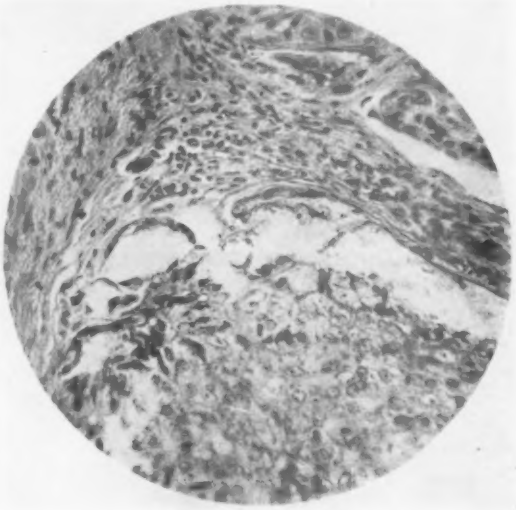

FIG. 17. High power.

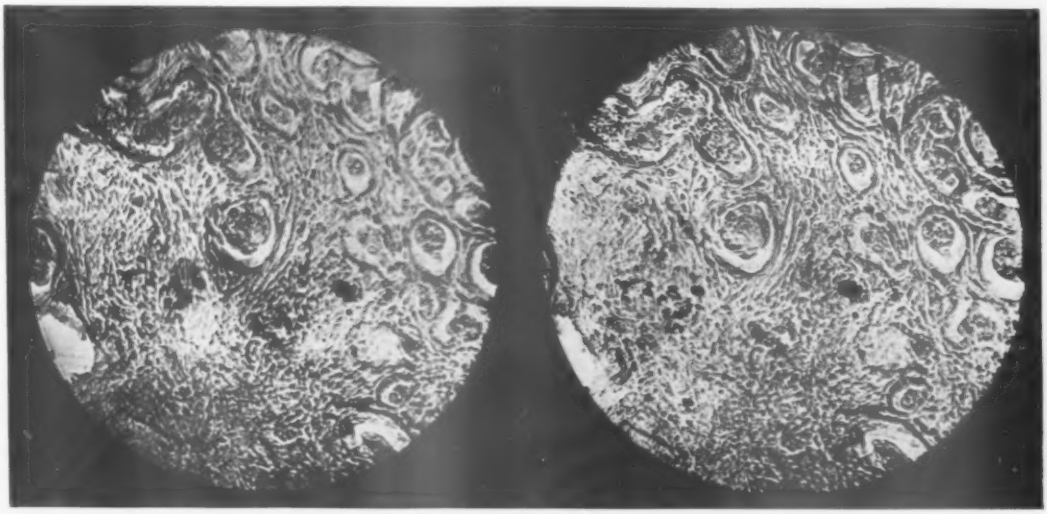

FIG. 18. Stereo-photo-micrograph.

In the single slide we lose all the perspective—all cells seem to be in one plane. I therefore recommend that all sections be studied by means of the stereo-micro-photograph.

An endless amount of work has been done to determine the lethal dose of the cancer cell, but up to date a definite dosage has not been established. We can say, however, that investigators have reached the point where they can tell approximately what a lethal dose should be. In this connection we desire to cite the conclusions reached by Drs. Francis Carter Wood and Frederick Prime,[1] of New York City, who base their conclusions on very extensive experimental work at the Crocker Research Laboratory of New York:

"The practical conclusion which may be drawn from these observations is that the amount of roentgen ray necessary to kill all the cells of a rapidly growing, very cellular, and highly malignant sarcoma or carcinoma in man, is between five and seven erythema doses of filtered roentgen ray, when the tumor is on the surface of the body. Every centimeter of tissue that covers the tumor makes an additional amount of roentgen ray necessary. For example, when slices of fibroid uterus are used as absorptive material, the galvanometer deflections show that at a depth of 2 cm., 19 per cent more roentgen ray is required; at 5 cm. depth, 47 per cent more, and at 10 cm. depth, 65 per cent more."

Before we accept the conclusions drawn by different investigators, we must bear in mind that it is absolutely inpossible to determine the lethal dose for a carcinoma cell because not all cancer cells are equally radio-receptive. Some types of carcinoma cells are more easily destroyed by small dosage and exposure than other varieties; in other words, the biological factor must not be lost sight of.

5. Theory of relative radiosensibility of normal and cancer cells

Radium and roentgen rays when applied in too large a dose will destroy normal as well as pathological cells. It requires, however, much larger dosage of rays to destroy a normal cell than would be required to destroy a cancer cell. It has been stated that both these agents have a selective action on certain cells, especially on embryonic or cancer cells.

This supposition is probably erroneous. Rays have no selective power for certain cells. They bombard all tissues alike, but the cancer cell has less resisting power against injury from the rays than the normal cell, and therefore succumbs more readily. In other words, the cancer cell is more radioreceptive. It is, likewise, more easily injured by other agents, such as heat. Cancer cells are destroyed at a temperature 15 to 30° lower than is required for the destruction of most normal tissues; thus in applying graduated heat in carcinomatous regions the cancer cells will perish while the normal cells will withstand higher degrees of temperature.

An explanation for this lack of resistance of the cancer cell is desirable. Many theories have been advanced, some of which are quite reasonable, others less so. One of the most favorable theories is the embryonal. The cancer cell is considered to be an embryonic cell, and since all embryonic cells are less resistant than the mature cells, they succumb more readily to the roentgen rays. This assertion brings up another question. How long does an embryonic cancer cell remain embryonic? All cellular structures before they become mature pass through the embryonal stage, just as human beings do. Whether or not the same law prevails in the case of cancer, I do not know. Is it possible that a cancer continues to increase in size, and all its cells remain embryonic?

Normal cells belonging to the body organization pass through the embryonal stage, become mature, fulfill their function, and when they are old, they are broken down, liquefied and eliminated, and replaced by new cells (metabolism). Does this also take place in the case of cancer, or does the cancer cell reproduction go on indefinitely without being broken down, until exposed to external injuries, such as roentgen rays, heat, surgery, or accidents? If the rays are really more injurious to all embryonal cells, whether they be the normal or cancer types, it would be a most dangerous procedure to expose the body to the ray, because it would destroy the normal embryonal cell, which would practically

[1] Wood, F. C. and Prime, F. Lethal dose of roentgen rays for cancer cells. *J. Am. M. Ass.*, 1920, lxxiv, 308–312.

mean gradual cell extinction. There must be some other factors in operation which give the normal cell a greater protection against radiation or other injurious agencies.

A study of this question requires a critical inquiry into the biologic phenomena and the etiologic factors of cancer. Unfortunately our knowledge on these two questions is still meager, but let us make deductions from what knowledge we possess up to date.

We must accept one logical conclusion, namely, that cancer is derived from the normal cells of the body. Since our entire organism is derived from one single cell, and no foreign cells are introduced into the body from the outside, we must conclude that the cancer cell is a child of the normal cell.

The question now arises: What causes this abnormal cell proliferation? What conditions are necessary to change a normal cell into a cancer cell? Loeb states that all conditions which produce a cell proliferation, through mechanical, physical, or chemical stimulation, that continues for a relatively long period of time, may be the cause of this transformation.

Fibiger was able to produce cancer in the stomach of rats by feeding them Nematode Spiroptera Neoplastica. Yamagira produced cancer of the skin in rabbits by a long-continued application of tar, and others produced the same on mice with this method. Marie and his associates have produced sarcoma in rats by long-continued application of the roentgen ray. Tissues which normally are not able to proliferate do not produce cancer. Loeb and Slye believe, and have demonstrated, that heredity is an important factor in production of cancer. They can, by selective mating, foretell not only which offspring will develop cancer, but they can also state which organ will be affected. These experiments are convincing and must be taken into account when we wish to get at the cause of cancer. We have now learned that several factors play a part in the causation, two of which are most conspicuous, namely, external and internal stimuli, and heredity.

Are both necessary for the causation? Is one sufficient? Loeb believes that either cause is sufficient, although when both are present the chances for cancer are much greater.

When we consider, however, that nearly all early operators with the roentgen ray developed carcinoma of the skin by the constant exposure to the rays, we realize that it is not likely that these operators were all predisposed by heredity to carcinoma; thus heredity alone is not an absolute requirement for cancer growth.

Loeb does not believe that microorganisms are directly causing cancer, but he does not deny the possibility.

Sinertsen and Dahlstrom[1] recently published a series of experiments to prove that the production of cancer depends a great deal upon muscular activity, or, rather the lack of it. They state, and prove by statistics, that people who are engaged in active muscular exercise, such as teachers of gymnastics, rarely get carcinoma, while the sluggish individuals and people of sedentary habits are more predisposed to it.

Whatever the actual cause or causes of cancer growth may be, the fact remains that the cancer cell, if not morphologically different, nevertheless is, and acts differently from the normal cell.

In my previous publication I advanced a theory which may not only throw additional light on the cause of cancer, but also may show why cancer cells succumb quickly to roentgen ray and radium and other injurious agents. A mass of cancer cells may be likened to an alienated, detached and lawless community, the members of which have no other function than self-nutriment and reproduction. It may be compared with an insurgent state or a group of revolting individuals, often found in peaceful communities, who do not wish to perform any labor and ask for everything that labor produces. They, too, appropriate plenty of nutriment for themselves in a lawless manner. A parasitic community. They know how to appropriate for themselves plenty of nourishment at the expense of the whole community, *but do not give any counter-service to the organism in return for the nutriment they receive.* These cells grow in a

[1] Sinertsen, Ivar, and Dahlstrom, A. W. The relation of muscular activity to carcinoma. *J. Cancer Research*, 1921, vi, 365–378.

lawless manner without any definite arrangement of structure or function.

Is it not reasonable to expect that these recalcitrant cells (cancer cells), *which render no service to the whole, are denied the same protection against all sorts of injuries of which the normal working cell of the body receives?* The normal working cell is a part of the organism and is under the control and the protection of the cell community; the cancer cell is not.

The central nervous system, which is the most important factor in the protection to cell life, is not supplied to the malignant growth. Only the normal cell constituents, such as connective tissue, which often invade the tumor, may be supplied with sensory nerve fibers. The pain which is associated with carcinoma is usually felt in the surrounding structure upon which the growth impinges. This pain acts as a warning sign that the growth is trying to invade the normal structures—an alarm. The cancer proper has no sensitive nerve fibers. It may be cauterized or cut into without the patient's discomfort, providing the surrounding structures are not touched.

There is a striking resemblance in the organization of cell community life to that of the human society. Jacques Loeb calls the body a society of tissues and the organs the complex cell. He claims that death is not inherent in the individual cell but is the fate of the more complex organisms in which different types of cells or tissues are dependent upon each other.

We believe, however, that death in the individual cell is just as natural as the death of complex organs.

Not all the tissues of the body are endowed with the same resistance to injury. Their tenacity varies with their importance in the preservation of life of the organism. To the cells most essential to life on the whole is given the greatest protection.

The organization of human beings and of cells illustrates that our body is merely a composite of many individual smaller units, each contributing to the welfare of the whole, just as each citizen contributes to the welfare of the human race. How far this cooperation in cell life functions we do not know. Cells may be even better organized than the human family.

There may be in the cell organization laws governing the nutrition and protection of the segregated clusters of recalcitrant cells. If there are cell workers, cell soldiers, cell judges, then why not cell thieves and cell prisoners? And so by analogy we may consistently reason that cancer cells do not share the same privileges that the normal working cells enjoy.

CONCLUSION

(*a*) Carcinoma may be considered an enemy or a parasite of the human organism, which has less resistance than the human organism itself. (*b*) We have now, I believe, the means of destroying cancer cells without material injury to the normal cells, provided we employ the agents at our disposal in a logical manner. (*c*) The best means we now possess are radical surgery combined with a scientific application of radiotherapy. We must, however, bear in mind that the application of these methods may influence the growth in more than one way. They may destroy it, may arrest or sterilize it, and even may accelerate the growth. Therefore, the roentgenologist and the surgeon must understand that in the possession of these therapeutic agencies, they have the means of doing a great deal of good and also a great deal of harm.

A statistical report of our work is not available at present, neither is it advisable, because the majority of cases treated by the method here advocated dates back only about one or two years. We have in our series of over 200 cases, some of which have stood a long test, one being fourteen years, another nine years, without recurrence. We fully realize that a great deal can be accomplished with the roentgen rays and radium alone, without the aid of surgery, and we do not subject every case to surgical operation. But we are trying to make a comparative study as to whether surgery combined with radiotherapy will accomplish more than either of them alone. Our results have not always been satisfactory, but we are not discouraged, for the class of cases in which this apparently

radical treatment is employed has very little to lose, and we are convinced that we have benefited a few and harmed none.

DISCUSSION

Dr. A. W. Crane, Kalamazoo, Mich. I think you will all agree with me that for a combination of daring and skill Dr. Beck is without an equal. I think no other surgeon in this country has dared to make so extensive an operation in case of malignant disease and to leave the entire field of operations open. The results which he has obtained certainly justify his procedure, and the addition of the roentgen ray according to his method may or may not be credited for some of his extraordinary results. There would seem to be a decided advantage in having so extensive a drainage of the field of malignancy.

The general subject of the relation of the surgeon to the roentgen operator brings up the general question of how we stand at the present time as roentgenologists in our relation to surgery. Certainly if we always worked with a man with such liberal views as Dr. Beck, so willing to undertake any operation, however formidable, in cooperation with the roentgenologist, we could perhaps have a better time of it.

At the present time when cases are referred to us for roentgen treatment either before or after operation, we must indeed pause, in view of some of the results. From my own limited experience, and especially from the experience of others that I have learned about, it would seem to be a hazardous matter for the surgeon to operate in case of malignant diseases too soon after the part has been irradiated. Within one or possibly two weeks after a thorough radiation in some cases there seems to be an especially dangerous time for the surgeon to operate. Recurrence may take place with extraordinary virulence and go to an extraordinary extent. But if we were able to administer a carcinoma dose (by which we would understand the destruction of the carcinoma cells, or the potential sterilization of that cell so it would no longer be able to undergo the process of cell division), after an interval such as thirty days, then we would seem to make cancer safe for the surgeon. As a matter of fact, the surgeon who cuts into a malignancy after it has received preliminary roentgen treatment, before a sufficient time has elapsed, is often met by a recurrence of unusual violence, when the cell certainly hasn't been destroyed and its capacity for cell division has not, apparently, been interfered with. On the contrary, it seems at times to have been stimulated. The cancer cells need to lie undisturbed for a certain period in tissues that have been radiated in order to meet fully the destructive processes set up by the roentgen ray. These processes immunizing, but otherwise strangely local.

This would bring up the subject which Dr. Knox and Dr. Pfahler, discussed last night, namely, the reaction of tissues to the cancer cells. That is certainly the important thing, just as it is in other types of roentgen treatment. For instance, the tubercle bacillus can be thoroughly irradiated and apparently its capacity to grow not interfered with, but in cases of tuberculous glands of the neck the roentgen treatment may bring about a complete cure. Apparently the only explanation of this is the reaction between the diseased tissue and the healthy tissue and fluids of the body.

Some fifteen years ago at a meeting of this Society in Cincinnati I had the temerity to read a paper entitled, "Immunity and *X*-Ray Therapeutics." I wouldn't dare do such a thing at the present time. But nevertheless it has never ceased to seem to me that some form of general immunity similar to other types of immunity must take place when the disintegrated cancer tissue is liberated within the body. There must be some kind of reaction, and if that reaction could be intelligently produced and controlled, it would solve much of our difficulty. If the problem is one of securing an immunity, how can we have team work with the surgeons? It is probably true that when we break down a lymphosarcoma of large mass, and such a vast quantity of disintegrated material is set loose in the body, we have what the immunologist would call a negative phase, and that the defenses of the body are broken down by such overwhelming toxemia. If that were true, then immediately following roentgen treatment, if the surgeon could remove a sufficient quantity of this material, possibly he might be of use notwithstanding the increased danger of metastases, but at the present time I feel that we are on the narrow edge of having to take a definite stand as to whether actually the roentgenologist can cooperate with the surgeon or whether he must consider that malignant disease must in each case either be regarded as wholly surgical or wholly a roentgenological problem.

Dr. Alden Williams, Grand Rapids, Mich. Dr. Crane, just as he sat down, made the statement that possibly we were on the borderline of deciding whether to use surgery or radiation. At least, that was what I gathered from his remarks. I think that I would hardly make quite so general a statement as that. It is very seldom that Dr. Crane's remarks are anything but conservative, and he probably

meant to say that there are cases in which there could be, or should be, no cooperation, cases in which the patient should be left entirely in the hands of the radiologist, and other cases in which the radiologist should keep entirely out of it and let the surgeon make his cure, which he can do alone.

Dr. Beck started off with cooperation as his first point. That requires, almost, a definition. It would be one definition from the surgeon and another from the radiologist. On the whole, it seems that the surgeons are consulting more with the radiologists over the country, and vice versa, and I think that this cooperation is working out for good. It does seem that we are all dissatisfied at receiving a patient who has been thoroughly mutilated and being asked to give five hours' therapy. I called up one of the surgeons in our town and asked him what he meant by five hours. He said, "Damned if I know." I presume that he had read somewhere that someone had given five hours. Possibly it was five milliamperes for one hour that he meant. I asked him if he objected to my going ahead with the case as I thought best, and he said "Go on." We find out, I believe, that in going at the matter tactfully we have thorough support. Such men as Dr. Beck have helped our cause. Dr. Beck in his association with the American College of Surgeons has always backed our cause, and it is through such men, who are both radiologists and surgeons, that we are making progress.

Dr. G. E. Pfahler, Philadelphia. I apologize for appearing before you so often, but some of the discussion has aroused my interest. I feel very definitely that for the good of the individual patient, and probably for the good of cancer therapy in general, it would be a very great advantage if there could be a preliminary conference between the radiologist—I will put him first—the surgeon, and the family physician, in which all phases of the interests of the patient who has the cancer would receive the best consideration.

I feel very strongly that if we can cooperate more closely with the surgeon and the family physician we will accomplish a great deal more than we would otherwise.

I do not feel, however, that every one of these cases, or even a great percentage of them, should be cut open and laid open for our treatment. I think that that involves much risk, though in some cases it is undoubtedly beneficial. The results that Dr. Beck has shown here, and that I have seen shown repeatedly before, are very convincing that in certain cases this is a desirable thing to do, but I think those cases should be chosen most carefully. I doubt very much that it was necessary, for instance, in the lip cases that he has shown. Certainly I can show equally good results without any such procedure and accomplished by radiation, or a combination of radiation and electrocoagulation. I do feel that even in those lip cases the surgeon can be of the greatest aid in helping to fix up the patient, after he has gotten well from his cancer, by doing a plastic operation, building up a new lip, closing up the mouth, or whatever it happens to be. We certainly must, and I do, continue to call on the surgeon for those purposes, and also for this preliminary advice as to what is best to do for the individual patient.

Now Dr. Crane has made some statements with which I can not agree, and which I think we must consider very carefully. I have treated many of these patients preliminary to operation, and I believe it is one of the two best things to be considered in practically every case of malignant disease. I tell the patients this, and I tell the family physician this, and I tell you this—I believe that one of two procedures today is best, but I do not know which. I think that remains to be determined by a long observation of carefully studied cases. One is a preliminary or a preoperative course of treatment, followed by radical operation and followed again by a second course of treatment.

The second recommendation is complete treatment by radiation combining roentgen rays and radium.

Dr. Crane. How soon would you have the patient operated on after the preliminary course?

Dr. Pfahler. Approximately two weeks, or as soon as they have passed the preliminary toxic stage, whatever duration that is. It will depend somewhat upon the technique and the treatment that has been given preliminary to the operation, so that one cannot lay down definite rules—but I think the average patient can be operated upon within two or three weeks from the time that we first see the patient and start our course of treatment.

Now, then, I have never seen the slightest evidence of stimulation of the growth. I have not yet had any rapid recurrence or dissemination of the disease. I certainly should have it, if the observations that Dr. Crane has made apply everywhere. I do not believe that it occurs as a result of the radiation. It may be that Dr. Crane has seen some rapidly disseminated cases that happened to develop more rapidly just at that time—more of a coincidence than anything else—but I have not observed it; and I say now what I have not said

before, but what I think ought to be said, I have never seen the stimulation of any growth by radiation at any time during my twenty-four years of radiotherapy. I have never seen, even when we worked with those minute doses, anything that suggested stimulation of the growth. In many instances the growth has gone on just about as it had progressed before, but I have not seen it stimulated. The experimental work shows, if you will follow it closely, that there is a stage when there is apparent stimulation. Dr. Mavor in his work on the fruit fly has found a certain stage in the development of these flies where there is an apparent stimulation, but as the flies go along there is always an evidence of retardation or interference with growth. This is true, practically, so far as I know, with all of the animals that have been experimented upon. So I do not believe we need expect this stimulation.

Now, then, what is the theory of this preliminary treatment? It is to devitalize the cancer cells. And why do we say they devitalize? Because of experimental work that has been done. Unfortunately I cannot give you the references, off-hand, but I think it is La Pointe who took first a series of mouse cancer that gave almost a constant or a universal take, and he exposed a tumor tissue alone in this instance. You will find these records in Colwell and Russ's book as well as in other literature. The tumor tissue was simply exposed and then inoculated, and another half-control which was not exposed gave the usual amount of takes while the tissue that was exposed to the rays either did not take, or took in a very low percentage. Now that is the theory upon which we give preoperative treatment with the thought of devitalizing the cancer cells, so that in the process of manipulation during operation, or implantation during operation these cells cannot immediately inoculate themselves in the open wound or cannot readily float into the circulation and be distributed elsewhere and grow. That is the theory of that side of it.

The other theory is just what Dr. Crane also referred to, but I think did not quite get the thought. That is, the work that has more recently been done at the Rockefeller Institute in which they exposed the field of inoculation and then inoculated and found that the growths, the tumors, would not develop.

Well, here we have the same process. We are exposing the field and then the surgeon operates and that tissue has been exposed; therefore the cancer cells should not, on that theory, at least, inoculate themselves.

I am convinced that a great deal of good has been accomplished. Just what it means in percentages it is hard to determine, because it is difficult to classify cases absolutely, but I do feel that this preoperative treatment is a thing to be considered.

Now the second line of action in the treatment of malignant disease, as I see it, is to treat the case straight through with roentgen rays, perhaps associated with radium applied locally to the tumor tissue. There is where Dr. Beck's work permits us to bring the radium particularly into direct contact with the tissue and get more intense action locally, and I think that is what he has accomplished by getting his radium rather than the roentgen rays in direct contact with the tumor tissue.

Dr. Wm. A. Evans, Detroit. I would like to defend Dr. Crane's stand. I heard from him that he had an experience lately regarding a case of recurrence. We have had two recently. Dr. Christie had others, and I believe there is a real danger in operating shortly following a deep exposure over a cancerous breast. I believe from reading and from observation, that cancer is not a local disease, even in the early stages, since it is proven pathologically that in an early cancer of the breast you will find cancer cells all over the body: they are in the blood vessels, the heart, lungs, and other parts of the body. The cells are under various stages of degeneration, and you do not remove the disease when you remove the local tumor. I think there is a real danger in operating too soon following deep therapy over a cancerous breast. I will say four weeks is the limit in our experience. We had one with a recurrence in three weeks, that is, operation three weeks following the treatment, and another recurrence in four weeks.

Dr. Crane. Ours was two weeks, or between two and three weeks.

Dr. Evans. I think there is a real danger there. I think it is a further proof that the disease is not local and there is a question of immunity that is interfered with both by surgery and by deep radiation.

Dr. Gray. Possibly Dr. Evans is creating a wrong impression when he says from his observations and reading that cancer is never a local disease. He says that there are cells in the heart and elsewhere. I wonder if he does not mean that there *may* be. If it is never a local disease, then every case of carcinoma of the breast that has been operated on has been a mistaken diagnosis if the case has been cured. I grant you that we may have dissemination of cancer cells when there is the slightest appearance of a primary growth, but I could never convince myself in the world that all of the cures for years and years by the surgeons by

the removal of the breast were on faulty diagnoses.

Dr. Robert Knox, London. Of course the proper discussion of a question of this kind would involve a very considerable amount of time. I could deal with one or two aspects of the paper.

To begin with, I agree with what Dr. Beck said at the beginning, that the question of the cure of cancer would never be settled by either surgery or radiation. I think when a cure is found it will be on lines of immunity, and whether we by our radiations induce a degree of immunity or not is not quite proved. I think we do to some extent. The question of the immunity production in the patients has been worked out at the Middlesex Hospital by surgeons and radiologists in collaboration. The technique, I think, was described by Professor Russ when in America on a recent visit. In inoperable cases of carcinoma a portion of the breast, a portion of the active tumor, is removed and treated to what Professor Russ calls a lethal dose of radiations. After the tissue has been thoroughly irradiated, it is inserted into the abdominal wall by the surgeon and in this way an attempt is made to immunize the patient. We have not had time to determine yet whether any beneficial result has followed from that treatment or not, but Professor Russ is very emphatic on this point when he states that in none of the cases so treated has there ever been local recurrence, a local manifestation of the cancer. Well, that is a very emphatic statement. I do not think it means very much, because the patient as a rule has been an advanced case of carcinoma, and is perhaps pretty well immunized by the cancer itself, so I do not think we can pay very much attention to that.

As far as the results go, some patients improve, and ultimately most of them die. But Mr. Sampson Haendly made one very important observation in discussing the matter with me. I have treated several cases which have been immunized in this way, with the *x*-ray treatment, and Mr. Haendly made the very significant observation that he had not found any benefit from the immunity process, but 1 or 2 cases, perhaps 3 or 4 cases, which had suppurated, had improved considerably as a result of the suppuration. Now that was a streptococcal infection of the wound and an abscess formation, and after the abscess cleared up the patient made fairly satisfactory progress, and I believe Mr. Haendly is now trying inoculations with streptococcal infections, in the hope that he will stimulate reactive processes in the patient.

In regard to stimulation by *x*-rays, I think it does undoubtedly occur. I have met with cases which have, after *x*-ray treatment, shown an alarming spread, which could not quite be explained by a natural extension of the growth. I think we have to reckon with it as a possible thing, and I think it is logical to assume that it is a possible thing, too, because an agent which is supposed to be so powerful for good must sometimes do some harm.

In regard to the preoperative treatment, I am entirely in favor of it if there is time. That is, if for any reason the patient cannot be operated upon at once, I give preoperative treatment; but I don't think I would be inclined to wait much longer than a month before suggesting that the operation should be done. I don't think we ought to delay in the hope that any effect we are going to get from the radiations is likely to be of much value. I think it is much more important to get the primary tumor removed and to continue the postoperative treatment as thoroughly as possible.

Now in London the gynecologists have been using radium in cervical carcinoma, and several gynecologists say they prefer to give a radium exposure—a good, strong, lengthy radium exposure prior to operation, then wait about one month or six weeks. Several surgeons who have carried out this technique say that the operation is rendered very much easier, and they find a great advantage from the preoperative treatment by radium.

I have treated several of these cases afterwards by *x*-rays to affect the glands as much as possible, and these patients have done extremely well. So from the point of view of radium, preoperative treatment in conditions of that kind is to be advised.

I am heartily in sympathy with any effort which means an attempt at collaboration between the surgeons and the radiologists. We can help one another, we have helped one another.

As far as we in England are concerned, I can assure you that the sympathy is genuine, and the cooperation is very effective.

Dr. Beck (closing). I will answer some of the questions.

The one asked by Dr. Crane: "How do we stand with the surgeons?" I think you stand very well with the surgeons, very much better than years ago. I am sorry to say, however, that sometimes, even now, surgeons will say: "There isn't anything in it." I heard a prominent surgeon state in a meeting of roentgenologists as large as this, that he had never seen a case of cancer cured by radiology and that he had seen many of them made worse; but that he had seen many cases cured by surgery. Such pessimism is rare. As I watch the surgical pro-

fession and their attitude, I see that year by year they have gained more and more confidence in radiology, especially if combined with surgery. If radiologists do not make too extravagant claims, I am sure they will find very helpful cooperation from surgeons.

I think the idea of Dr. Pfahler is a very good one. Surgeons, physicians and radiologists should come together and discuss their problems. I have learned a great deal in these meetings, and, therefore, I am not skeptical, although I used to be. Dr. Pfahler got the wrong impression if he thought that every case that comes to us with cancer is subjected to this kind of an operation. We have an efficient department for radiology, where we treat most of the cases without surgery. There are many cases, however, such as carcinoma of the prostate gland, upon which we no longer attempt to operate.

So far as the preoperative radiation is concerned, I know now a great deal less than I did before. Some of you gentlemen say it shouldn't be done, and others say it should be. I will have to decide then for myself.

PROBLEM OF DEEP THERAPY*

BY GUSTAV BUCKY, M.D.

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NO one will claim that the problems of deep therapy have already been solved. Since this is so, it is often very helpful to make a critical survey of the predominant points of view, even if we are not able to answer all questions satisfactorily or to point the way that must be traversed.

Before we proceed further, it is necessary to recognize one fact as essential—that for the study and practice of this therapy, an absolutely accurate measurement is indispensable.

Several fundamental reasons for present-day views and for the technique of rays should receive close examination.

By far the most important point is the assumption that the effect of the roentgen rays depends on the quantity, not the quality, of the absorbed rays. But if we review the literature, we cannot escape the impression that there is no absolute proof of this assumption, since the biological experiments, as well as the clinical treatment, have always been made either with heterogeneous rays or with only the hardest part of the roentgen-ray spectrum. Indisputable experiments with moderately hard homogeneous rays failed because of the impossibility of producing these rays in the necessary quantity. Probably the time has now come when the advancement of the measurement technique enables us to make such investigations.

But if we want to assume from the foregoing that as a matter of fact only the absorbed quantity causes the effect, we cannot then explain how it was possible to get results at all in the past. For instance, we cured myoma with soft and almost unfiltered rays. If we compare the doses in the depth *then* with those of today, we will see that we had only a fraction of the quantity which is today assumed to be necessary for result. But if the quantity was insufficient and nevertheless the result was apparent, then one easily concludes that the explanation may be found in the quality of the rays. It is also remarkable that the roentgen disease, the so-called "Rontgenkater," increases with the hardness of the rays. Let us assume that we irradiate two almost similar myomas with the result that in both cases an amenorrhea is reached. Each patient should be treated with different quality of rays. Then we will see that the one treated with the hard rays will show more severe symptoms of roentgen sickness than the one treated with softer rays; and this, in spite of all precautions in regard to ventilation, etc. Even if we examine our patients in general and compare the recent cases with those treated in former years, the large increase of roentgen sickness is evident. Every expert will bear this out. One can reply to this that only the increased dose in the depth with resultant decay of the pathological tissue and absorption, is responsible for the greater roentgen sickness. This is not so, because the decay of the pathological tissue certainly takes place later than the appearance of the

* Read at the Twenty-fourth Annual Meeting of THE AMERICAN ROENTGEN RAY SOCIETY, Chicago, Ill., Sept. 18–21, 1923.

roentgen-sickness. Nobody will assume that in case of myoma treatment, the myoma or the ovaries immediately begin to disintegrate. On the contrary, the ovaries often function after four weeks and, in most cases, at least one menstruation takes place after irradiation. The reason for the more severe sickness, therefore, is to be found in the harder quality of the rays as they attack the healthy tissue more forcibly. This is proved also, by the blood picture.

Therefore, we cannot deny that probably the length of the waves is a very important factor in the result, and that very probably there exists a specific effect due to the quality of the rays. We have these differences in quality with other rays, therefore why not here? It is of fundamental importance to take up this question again since we now have ways and means to solve it.

Another principle of our present-day method is that a definite quantity of rays (absorbed dose) always has the same effect on a certain organ or tissue, so-called carcinoma dose, castration dose, etc. Now, everywhere in medicine we find that the effect of all our therapeutics depends on the most varied factors—individual predisposition, tolerance, idiosyncrasy, the general condition of the body, etc. It is more than likely that this holds true for roentgen rays also, because we know that different individuals, in spite of the same dose, get roentgen sickness of different intensities. It is also observed that upon repetition of the treatment there may occur more severe roentgen sickness after each treatment. It has also been noticed that roentgen treatment of carcinoma in cachectic patients often produces no reaction in the carcinoma. In all these examples we see the various effects of similar doses. Is it at all permissible under these circumstances to fix definite doses regardless of the well-known varied sensibility of tumors of the same type?

It is more or less assumed that the cure of tumors is brought about by the direct destruction of the pathological cells by the roentgen rays. Therefore the largest possible doses are considered the most effective, and endeavor is made to increase the doses in the depth by all possible means. Is this assumption correct? It is known that one can irradiate a dead tissue indefinitely without noticing any change or destruction. But since it is established that changes of the tissue in the living body are noticeable, we can conclude that the roentgen rays act on the function of the cells. Through changes in the atom structure, metabolism or what not, the cell is devitalized or destroyed. But if the pathological cell disappears, it must be replaced by a healthy cell. There is a continuous struggle between the normal and the pathological cell, and the stronger is the victor. The cure depends, therefore, on the fact that the healthy cells win out, not because the rays destroy the pathological cells, but because they weaken them and thereby assist the healthy cells. The battle is carried on by the cell. In other words, the tumor with its tendency to spread, moves centrifugally from its source and strives to invade the surrounding structures. The surrounding tissue, however, strives to drive out the enemy which threatens it with death, and tries to take its place. That means that the surrounding tissue moves centripetally to the source of the tumor. Depending upon which is the stronger, the result is either destruction and spreading out, or recovery.

We learn from this that we ought to weaken the pathological cells without affecting in the least the surrounding healthy cells. Our aim, therefore, should be to give such a dose as will retard the pathological cell without attacking the healthy tissue to an appreciable degree. It appears desirable, therefore, to make the dose dependent on the influence on the healthy cells in the neighborhood of the pathological cells. That seems to be the right goal. The skin evidences cannot be taken as a guide because it gives us no information about what is going on in the deeper tissue layers.

One, therefore, comes to doubt if the large deep doses are at all advisable as they are measured by the physicists. For similar reasons it seems very problematical if we are justified in increasing the deep dose in any way. You know that above all we use the very hard rays for increasing the deep dose. In proportion as the hardness of the

rays increases, so do the scattered rays, and along with them the physically measured deep dose. The scattered rays spread in all directions so that much more healthy tissue is penetrated in the region of the cone of primary rays than would be the case with softer rays. The consequence of this is that the healthy cells are more strongly affected and are weakened. We therefore get a result which seems, according to the considerations above, not to be desired, since the defensive strength of the healthy against the pathological tissue is weakened.

Finally, let us call attention to the so-called "reiz dosen" (stimulation doses). It is claimed that small quantities of rays stimulate the growth of the tissue and that it is therefore dangerous to give small doses in malignant tumors. Holzknecht has found in the entire literature only 2 cases where small doses have caused such irritation. Furthermore, we have given, in previous times, proportionally small doses as compared with those given at present, without any appearance of stimulation. Haenisch reports 1 case of sarcoma of the neck in which he gave a large dose which led to an acute compression of the trachea two days after raying. Petry rayed lilac buds with very large doses and observed a quick and rapid development of the flowers, followed, however, by a speedy death. This indicates that stimulation results also from large, and even maximum doses. In these cases there appears to be a more rapid growth than after small doses, but quick destruction follows. The existence of so-called "reiz dosen" is at least doubtful if you expect to produce it only by small quantities of rays. In every case the danger of stimulation is greater with large than with small doses. You will hardly be able to support the demand for large doses.

These considerations lead to the following conclusions:

1. The right to establish a standard tissue-dose or organ-dose (so-called mathematical or physical doses) applicable in every case, is decidedly doubtful. More than that, it appears advisable to give the dose according to the appearance of the healthy cells which surround the organ to be treated.

2. Over-large doses, even if they show only slight skin symptoms, do not seem to be advisable. Just as little is it advisable to grade the dose according to the skin appearances.

3. The use of extremely hard rays seems to be inadvisable.

4. During treatment much attention should be given to the general appearance and state of health.

5. Special consideration should be given to biological in addition to physical research, particularly to clear up the very important question of the connection of the wave-length with biological effect.

These conclusions contain a program of research. It would be in the interest of humanity to find ways and means to solve them.

DISCUSSION

R. T. LEUCUTIA, Detroit. My discussion is directed especially to Dr. Bucky's paper and the point I desire to consider is the question of dosage in deep roentgen therapy, as practiced at the present time.

During the past two days, the opinion has been expressed at this meeting that the "massive dose" treatment has passed its time and in consequence the administration of more moderate, so-called "fractional doses" has been advocated. On the other hand, we have presented this morning a number of cases illustrating complete eradication of the disease where massive doses have been used. I should like to try to get these two methods of treatment in harmony and to find some basis which will explain the use of both of these apparently opposed methods.

Dr. Knox, in a very brilliant paper last night, arrived at some important conclusions with regard to the action of roentgen rays on pathological cells. He was of the opinion that the more undifferentiated the cells are, and the more atypical their mitosis, the more sensitive they are to radiation; consequently, the better the results to be expected. However, in addition to this primary action of the roentgen ray on the tumor cells, there is another process to be considered, namely, the secondary action produced by the reaction from the site of the irradiated normal tissues surrounding the tumor mass. This secondary action is certainly of no less importance than the primary action on the cells.

Dr. Bucky, in his paper, expressed the same opinion in another way. He talks of a centri-

petal and centrifugal action which exists between the tumor and the surrounding tissues, and he thinks that our aim should be to stimulate the centripetal action of the surrounding tissues rather than to destroy the centrifugal action of the tumor itself. In consequence, he advocates the administration of moderate doses repeated at shorter intervals.

In our cases, brought to your attention this morning, you certainly have observed that by administering the massive dose, the best results were obtained in tumors of the *embryonal* type, which are rich in cellular structures, while the tumors of the *adult* type, especially those rich in paraplastic structures have shown only little or no response to the massive radiation. The reason for this, I believe, lies in the fact that when treating a tumor of the embryonal type the highest dose required for the destruction of the cells forming the tumor mass (90 per cent S. E. D.) is lower than the dose which would destroy the normal cells surrounding the tumor. In the case of a tumor rich in paraplastic structures, the dose required for the destruction of the growth would be so high that it would damage normal tissue before having any effect on the pathological tissues themselves. Indeed, it seems that in tumors of the embryonal type, the massive dose tending to destroy the lesion and consequently to eradicate the disease in as short time as possible is the method to be chosen; while in adult tumors, or growth near to the adult type, a dose stimulating the action of normal tissues surrounding the tumor is rather to be preferred. These latter are the tumors where the fractional doses, repeated at shorter intervals—as mentioned so often during the past two days—will give more satisfactory results. Of course, between these two extremes, there are a number of intermediate tumors in which both methods may give good results, or may fail. These tumors will always form a large field for future investigations and discussions.

I should like to point out to you that when we talk of a "massive dose" we do not mean the concentrated massive dose, administered in one sitting, as it is practiced in Germany, but the divided (non-concentrated) massive dose; that is, a massive dose spread over a period of several days, according to the tolerance limit of the patient. As you see, this technique—in opposition to the technique of the fractional dose, where moderate exposures are repeated at shorter or longer intervals—tries also to administer the dose in as short a time as possible, but pays more attention to the general reaction and gives the patient ample time to recover from the ill effects of the individual treatments. However, rarely is the treatment spread over a period longer than one week, except in cases of generalized, systemic diseases such as lymphosarcoma, Hodgkin's disease, lymphatic leucemia, etc., where numerous exposures (even fifteen to twenty areas) are necessary.

The administration of the massive dose, as described above, has also, I believe, another advantage; namely, that it stimulates a general reaction of the defense mechanism of the body. We do not, as yet, know anything about sarcoma or carcinoma immunity, so it would be too far-reaching to enter into theoretical discussions regarding this problem. However, in our cases mentioned this morning, there was an angiosarcoma of the iliac bone producing extensive metastases to the lungs, which, after a massive dose treatment of both the pelvis and the lungs, not only completely disappeared for a period of over a year, but has shown no signs of metastasis in any other part of the body. Indeed, it is hard to imagine that the metastatic sarcoma cells have lodged only in the lungs without being carried by the blood stream to other organs of the body; and still the patient has remained free from metastasis. Another example: In lymphosarcomata, we treated at the beginning only the local manifestation and the evident metastases; but shortly following the treatment other metastases appeared which did not respond to further radiation, and the patients died. At the present time, we treat right from the beginning the whole lymphatic system, giving heroic doses (as many as fifteen to twenty exposures) and the results are striking; all our patients remained alive for a period of over a year and a half. It seems, indeed, that following the administration of such heavy doses, formation of some kind of antibodies is stimulated, which help to kill or encapsulate individual cells circulating in the blood stream or already lodged in other organs of the body not exposed to radiation. It may be that this is not an immunity process in the perfect sense of the word, but it is certain that something happened which is very near to that immunity. Future investigations will show what this is and whether it really deserves the importance predicted at the present time.

THE DIAGNOSIS AND TREATMENT OF ENLARGED THYMUS*

BY G. W. GRIER, M.D.

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THE object of this paper is to call attention to the comparative frequency of enlarged thymus, to state some observations in diagnosis and to discuss our experience in the treatment of this condition with radium. My remarks will refer chiefly to new-born babies or young infants. Undoubtedly, many backward babies suffer from this condition, unrecognized, and probably not a few of the deaths in infants occurring during the first few days of life are due to this cause. I have recently seen 2 cases where new-born babies living but a few hours were roentgenographed post-mortem for possible cause of death, and marked enlargement of the thymus found in each.

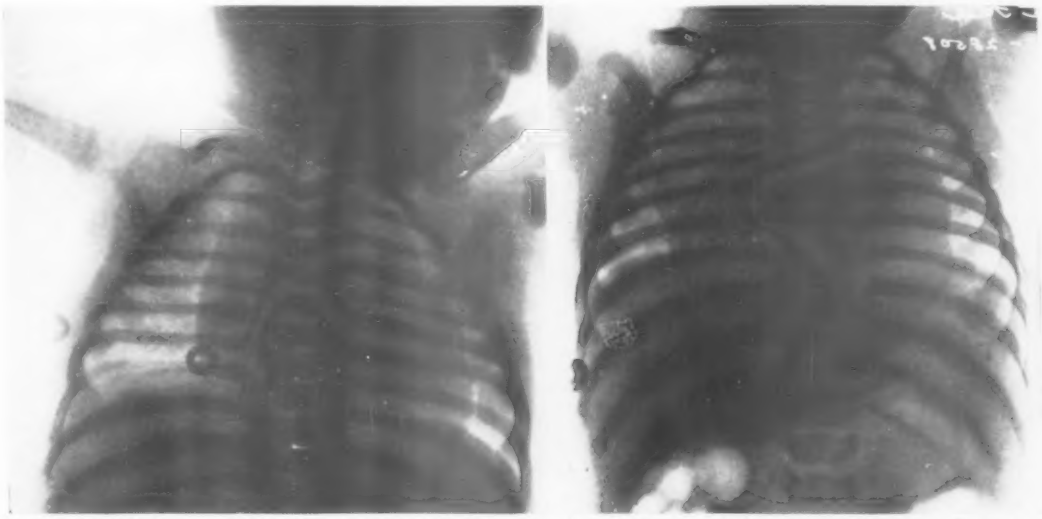

FIG. 1. Enlarged thymus. Two exposures, same baby, same date and same sitting. In one exposure, baby is crying and in the other it is quiet.

At the Magee Maternity Hospital, Pittsburgh, during the last year and a half, the Roentgen Department has diagnosed 18 cases of enlarged thymus in new-born babies. During this time there have been 2,700 deliveries. In the last two years we have seen 12 cases in our private laboratory and certainly as many more in our roentgen services at the Passavant, Presbyterian and St. John's Hospitals. The average roentgenologist then, sees a fair number of these cases, and in the majority of them, the final diagnosis and the treatment rest in his hands. This is an unusual responsibility for a roentgenologist to assume and it therefore behooves him to keep himself thoroughly familiar with this subject. If, then, I have little new to offer, I hope I will be pardoned the repetition of facts already known, since occasional discussion will keep our minds fresh on the subject. Probably the outstanding clinical sign is dyspnea of varying severity, sometimes very slight and accompanied by a peculiar crowing inspiration when the baby cries. This so-called thymic stridor, I believe, is the one characteristic sign. Dyspnea and cyanosis may or may not be present, depending upon the extent of the enlargement. If the condition goes unrecognized, the baby will be undernourished, weak and puny, pasty in color, probably with the sniffles and prone to take colds. However, none of these symptoms are pathognomonic, and the final diagnosis rests on the roentgenogram. Several of our cases have been premature

* Read at the Twenty-fourth Annual Meeting of THE AMERICAN ROENTGEN RAY SOCIETY, Chicago, Ill., Sept. 18–21, 1923.

babies, and I believe it would be wise to make a roentgenogram of all premature infants in order to see if this condition is present.

The roentgen appearance of the thymus shadow has been well described by Lange, Heublein and others. I will not take the time to repeat this description except to call attention to the fact that the thymus shadow usually extends on both sides of the spine and that the lateral borders are convex or bulging, and not concave, as is usually seen in tuberculous adentitis of the superior mediastinum. Also, that the shadow is wider below where it merges with the base of the heart than it is above at the base of the neck. Probably the main point of differentiation between the thymus shadow and other masses in the mediastinum which might be confused with it, is that the thymus shadow is more or less symmetrical on both sides and that it is wider below than above. It fits down over the base of the heart like a cap on one's head. The thymus shadow increases remarkably in size when the baby cries, and it is chiefly to call attention to this fact that this paper is presented. The significance of this fact is twofold: (1) If the enlargement is only moderate, it it may not be recognized unless the baby is allowed to cry during the exposure; (2) plates made during the course of treatment to note reduction in size are only comparable when made with the infant in the same state; that is, crying or quiet. If possible, it is interesting to have an exposure both ways at each examination.

The enlargement, when the baby cries, is, I believe, due to two causes: (1) An engorgement of the gland with blood as a part of the general congestion of the blood vessels above the diaphragm; (2) the elevation of the diaphragm incident to the forced expiration during crying. The latter, I believe, is the more important of the two because it lifts the heart up and consequently the thymus lying above the heart; and as it is lifted up it spreads out on each side. The fact that the diaphragm is higher during crying is easily demonstrated by comparing its level upon the ribs with that when quiet. Since it is impossible to control the actions of an infant the exposures, of course, must be practically instantaneous; that is, in one-tenth of a second or less. This is particularly true if the baby is crying. Fortunately, this is entirely possible with all makes of up-to-date apparatus. If a record is not kept of the fact as to whether the baby is crying or quiet during the exposure, the same end may be arrived at by noting the level of the diaphragm in comparison with the ribs. Plates made at different

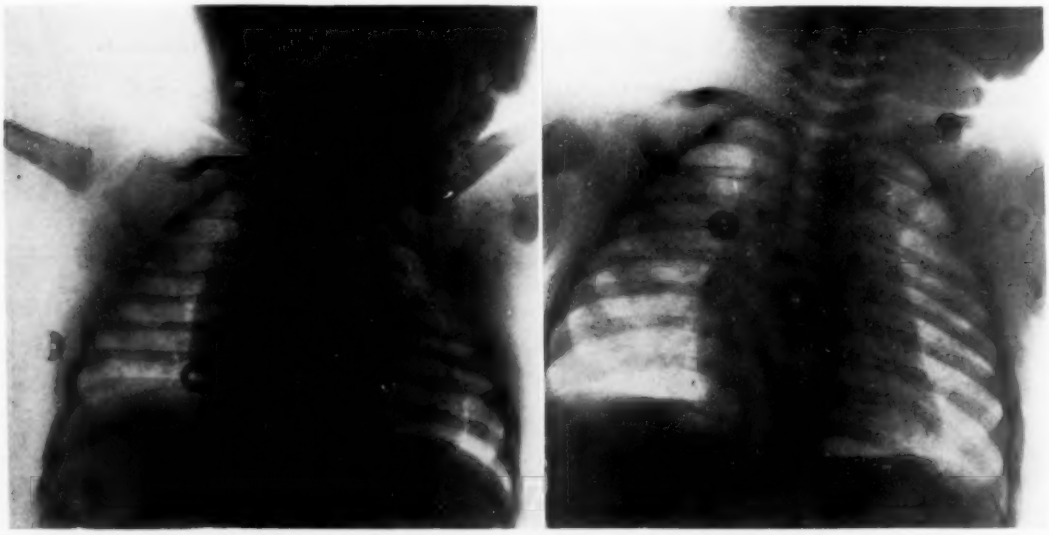

FIG. 2. Same case as in Figure 1; six weeks later, showing result of treatment. Baby quiet at both exposures.

times are only comparable when the diaphragm is level with the same rib. For instance, with the baby quiet the right diaphragm may be on a level with the ninth rib and when it cries it will ascend to the level of the seventh rib. The shadow of the thymus in the second plate will be much wider than in the first, due to the shortening of the chest. This must be taken into account when considering the result of treatment, since if the first plate is made with the baby crying and the plate after treatment with the baby quiet, the reduction in size will appear to be greater than it really is, and vice versa.

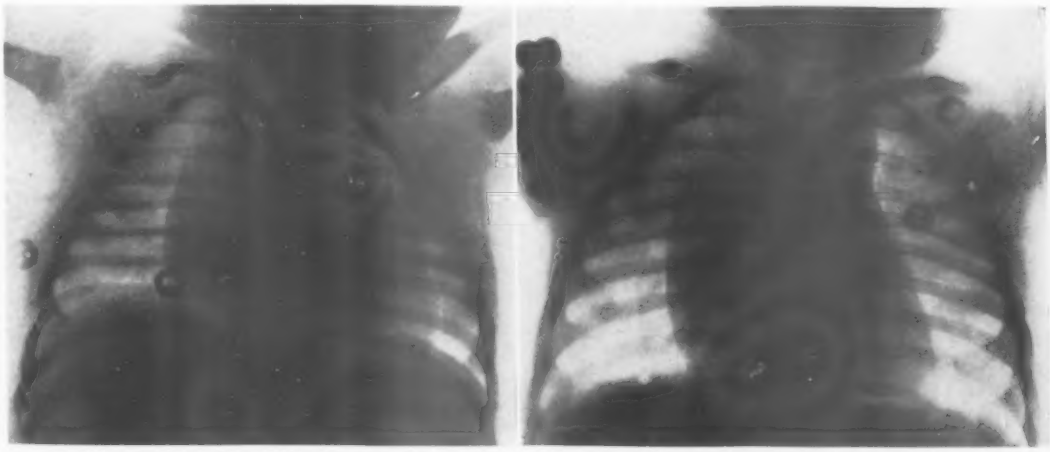

FIG. 3. Same case as in Figure 1, showing view before treatment with baby quiet and after treatment with baby crying, giving an unfavorable idea as to result of treatment.

Treatment: There are few instances in medicine where the introduction of a new method of treatment has produced such remarkable improvement in results as in roentgenotherapy of enlarged thymus. Before the roentgen era, practically the only treatment was surgical removal. The operation is a serious one, and the percentage of recoveries very low. It is true that the condition is not necessarily fatal if untreated, but the mortality under such circumstances is certainly very high Under roentgenotherapy, the percentage of complete cures is correspondingly high, and if the condition is discovered early and treated promptly, the danger of a thymic death is remote.

While the results from the use of roentgen rays are very satisfactory, I have abandoned this treatment in favor of radium, mainly for two reasons: (1) Quicker response to treatment, (2) greater ease and safety of application.

While it may be possible to give a sufficiently large dose of roentgen rays at one treatment to produce the same rapid response as from radium, we have never been fortunate enough to see this. Usually two or three roentgen treatments are necessary to produce any noticeable diminution in size, and to give these requires from four to six weeks. The effect from one radium treatment is apparent in a few days. The difficulties in administering roentgen treatment to a small baby are also considerable. The baby must be held by other persons who run the risk of exposure to high voltage currents and to the roentgen-ray beam in their efforts to keep the patient still and in the proper position. Lead masks placed to expose the thymus area are apt to slip, and thus cause the treatment to be administered where it will do no good. And above all, the efforts at restraint practiced on the baby produce violent paroxysms of crying which may be dangerous, in that they increase the size of the thymus and may superinduce strangulation.

Compare with this the application of radium, placed and retained in exactly the location desired without producing any alarm or discomfort to the patient and with superior results, and no one who has ever tried both methods will hesitate in his

choice. The dosage of radium required to produce a favorable result is not large. I am confident that the thymus can be sufficiently reduced in size without producing even an erythema of the skin. There are undoubtedly many minor differences in technique among radium therapists which do not alter materially the final result. However, if one follows the technique of another, he should adhere to it strictly in all respects. The main factors governing dosage are the quantity of radium used, its distribution, whether in one or several capsules, the distance from the skin and the number of areas treated.

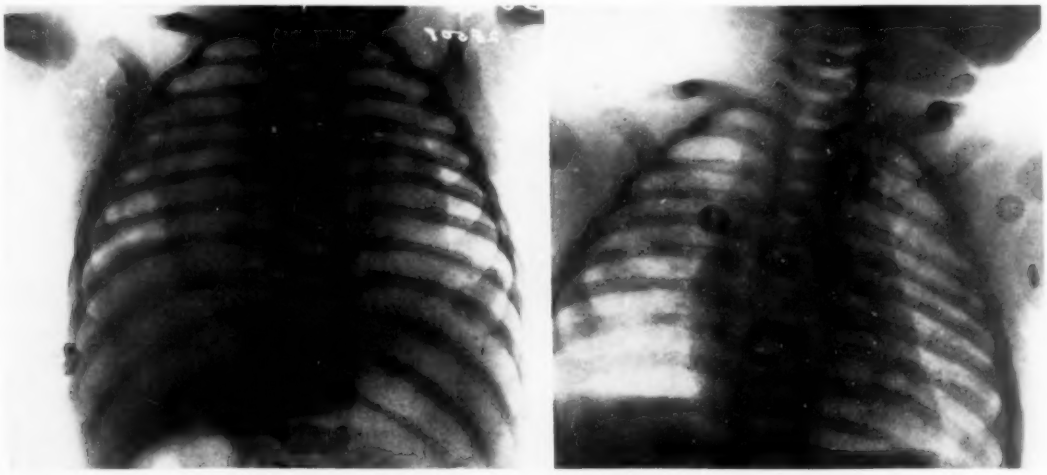

FIG. 4. Same case as in Figure 1, showing view before treatment with baby crying and after treatment with baby still. Decrease in size is apparently greater than it really is.

One hundred mg. of radium in one capsule and moved about over different areas has a different effect from the same quantity divided into four capsules of 25 mg. each and scattered about over one area, even if the same distance from the skin and the same number of milligram hours are used. It should be remembered that where adjoining areas are exposed, each area receives a part of a dose when the adjacent area is exposed. In an ordinary sized area of about 1 × 2 in. this extra dosage amounts to about one-quarter of the dose applied to each area, so that if four adjoining areas are treated, each area receives exactly twice the dose directly applied to it.

The technique which I have used satisfactorily for some time is to place four tubes of radium, each containing 25 mg., in a wooden block with holes bored in it 1 in. apart to contain the capsules. The filter used is 1 mm. of brass. The block is left in position for ten hours with the radium at a distance of three-fourths of an inch from the skin. This dose does not produce an erythema, and usually one treatment is all that is necessary, although occasionally it has to be repeated. It is an entirely safe dose and can be increased to twelve or fourteen hours if desired, although I have not considered it necessary.

A point that I wish to emphasize strongly is that the radium must be kept at the selected skin distance, or the dosage is entirely different from what is intended, and very small changes in this distance make considerable differences in dosage. For instance if the maximum dosage at three-fourths of an inch is fourteen hours, the maximum dosage at five-eighths of an inch is ten hours, and it is impossible for one to guess the difference between three-fourths of an inch distance and five-eighths of an inch. This distance must be carefully measured and the applicator used must be rigid, so as to maintain it constantly. The practice occasionally followed of rolling the radium up in a piece of gauze for an applicator is a dangerous one and cannot be condemned too strongly. It is important that the radium applicator should be covered on the upper surface

with lead because it comes high up under the baby's chin and is apt to produce a burn at that place unless this precaution is taken.

SUMMARY

1. One should be on the alert for enlarged thymus in young infants, especially in those of premature birth.

2. Heavy breathing, a crowing inspiration and later on a failure to thrive, should direct one's suspicions to this condition.

3. The thymus enlarges greatly when the baby cries.

4. Radium treatment is practically a specific.

5. The technique of the radium application should be carried out carefully and accurately.

DISCUSSION

Dr. L. T. LeWald, New York. In regard to Dr. Grier's paper I think we must distinguish between the function of the thymus and its secretion, and its size. He brought out the point that in some of these cases the gland still remained large roentgenographically and still the child was relieved of all symptoms. I showed in some roentgenograms at the lantern slide exhibit, twins who were perfectly well, but the thymus gland was enlarged in each one.

Dr. G. W. Holmes, Boston. May I take the time to say just a word? I think that Dr. Grier's calling attention to the necessity of making a record as to whether or not the child is crying, in other words, the influence of crying on these findings, is a very important one—a fact which has not been brought out so much as it should be.

There is one other point that I hoped he would bring out, and that is the degree of variation found in normals. The thorax of the child is very flexible, and during inspiration and expiration, even though the child is not crying, there is a considerable difference in the intrathoracic pressure and in the supracardiac shadow. The structures that go to make up the shadow include not only the thymus but the great veins, and engorgement of the great veins may simulate very closely the shadow of the thymus. I simply call attention to this fact and I wish Dr. Grier would tell us what have been his observations.

Dr. W. M. Doughty, Cincinnati. About twelve or fourteen years ago I happened to be present during the experiments of Dr. Lange on rabbits.

We are still trying to get our films of the thymus with the child quiet. It is essential to have the child perfectly straight upon the film, and pass the center ray through the center of the thymus, otherwise the smaller enlargements may not be shown.

We use the roentgen-ray treatments as they can be given in four or five minutes, giving two treatments within an interval of ten days. Ten days after the second treatment we made a film, and if there is an appreciable enlargement remaining or definite symptoms still present, we give a third treatment.

In cases of extremely small enlargement, but definite symptoms, we follow the dictum of Dr. Forcheimer, and give the therapeutic test. Many of these cases will clear up following treatments, even though definite enlargement of the gland was not present.

Dr. H. J. Ullman, Santa Barbara, Calif. Dr. Grier said that one obtained quicker results from the use of radium than from the roentgen ray.

At the Children's Memorial Hospital here in Chicago we rayed a number of thymuses at intervals, and the report usually was that the dyspnea and stridor occurring at night would be relieved the same night that the treatment was given.

I would like to ask Dr. Grier how soon he can repeat the radium dosage that he uses.

Dr. Grier (closing). I did not mean to make any reflections against roentgen-ray treatment of the thymus. I am sure it is perfectly satisfactory. I have been using it myself for years. I simply wanted to call attention to the fact that where radium and the roentgen ray were both available the radium was a much more satisfactory method of treatment, and I believe somewhat superior.

In regard to Dr. Doughty's remarks: I think that if I had only one exposure with the baby either crying or quiet, I would rather the baby should be crying because then I would know that we would not miss those cases in which the enlargement was only slight.

To discuss Dr. Holmes' remarks: I have not seen anything that we thought could be confused with a thymus shadow in the superior mediastinum. I do not believe this plays a very large part and I do not believe it is very often a source of error. The point that I wanted to make is that there is a big difference between the size of the thymus when the baby cries and when it is quiet, and unless you take this

into account you may not recognize what the size of the thymus is.

The radium dose could be repeated in six weeks, although I have not repeated it inside of three months, because I wanted to give plenty of time for the thymus to decrease in size. I rather suspect what has been mentioned here a couple of times, that the baby has been relieved without a complete return of the size of the thymus to normal. Therefore, we have not repeated inside of three months, and many times not at all.

THE GENERALIZED TYPE OF OSTEITIS FIBROSA CYSTICA—VON RECKLINGHAUSEN'S DISEASE*

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INTRODUCTORY

THE localized form of osteitis fibrosa cystica occurs rather frequently and numerous cases have been reported in the literature. The generalized form, however, is of rare occurrence and since von Recklinghausen's classical description of the disease in 1891, only a few sporadic cases have been added to medical literature.

The disease was first described by Hirschberg in 1886, who regarded the condition as a form of osteomalacia. Five years later (1891) von Recklinghausen reported 3 cases and concluded that the disease was a separate entity, which he designated as osteitis fibrosa cystica. Previous to the articles of Hirschberg and von Recklinghausen, typical cases with cysts and osteomalacia were reported by Froriep in 1840, Engel in 1864, and Langendorf and Mommsen in 1875. These are now classified as belonging to the von Recklinghausen type of osteitis fibrosa.

The total number of cases reported since von Recklinghausen's original contribution is still very small. Lotsch, in 1915, reviewed the literature and found reports of 37 cases, and Roth, in 1920, found only 40. Morton's article is the most extensive publication of the disease in the American literature. He gives a complete review of the reported cases and classifies 63 cases as belonging to the generalized type, including the report of a case seen by Lovett. Bloodgood, Myerding, Barrie, Young and Cooperman have also furnished valuable contributions to the American literature. Bloodgood in numerous publications, describes both the generalized and localized types of the disease.

REPORT OF CASES

The two following cases are reported, first, because of the rarity of the disease, especially in the United States; and second to show the characteristic roentgenographic appearance of the diseased bones.

Case 1. A school girl, aged fourteen, white; presented herself for examination in April, 1920, because of deformity of the left wrist, shoulder and back. Most of the history was obtained from the girl's mother.

Family History. The family history was essentially negative. Father living, aged sixty-nine, had had apoplexy. Mother living, aged fifty-four, health good. Patient is youngest of eight children.

Past History. She had had no illnesses, except measles, chicken-pox and whooping-cough. When a few months old, deformity of the left wrist was noted and as she grew it was noticed that the left forearm was shorter than the right. She was born with a lower incisor tooth erupted and at three weeks an upper incisor tooth appeared. She has never been so robust as the other children of the family. At the age of five she began to complain of aching in the joints, especially the knees. This was worse at night, often keeping her awake. She has complained of vague rheumatic joint pains most of her life, although not severe enough to prevent her from taking an active part with other children in play or work. She has never

*Thesis for membership in THE AMERICAN ROENTGEN RAY SOCIETY, 1923.

had tonsillitis or frequent colds, but has always been constipated and frequently takes a laxative. Appetite has always been poor. Does not care for milk, eggs or cereals of any kind. Eats very few vegetables; cares mostly for fruit, crab meat or steak. Sleeps well and dreams but little. She has never menstruated. Mother menstruated at age of sixteen and two sisters at age of fourteen and fifteen.

In April, 1920, first noticed crooked back. For past year there has been much less pain in the joints. Recently she has had infrequent headaches at night. In June, 1921, she fractured her right forearm while skating. This was kept in splint three months.

FIG. 1. Case I. Roentgenogram of the chest showing curvature of the spine and fibrocystic areas involving the vertebral ends of the ribs. Note elongation of the transverse processes of the seventh cervical vertebra.

Patient is active, runs, and is not incapacitated in any way; has attended school regularly and is now entering the first year in high school.

Physical Examination. April, 1920. Height 54 in., weight 72 lbs.; temperature 98.6; pulse 74; blood pressure 118/75. Fairly well-nourished young blonde girl with a rather marked right lateral spinal curvature, and drooping of the left shoulder which appears to be smaller than the right side. The left forearm is 1 in. shorter than the right, and the radius and ulna appear bulbous at the distal extremities. The ulna is distinctly shorter than the radius. The wrist joint movements are unimpaired.

No abnormalities noted in the head. Pupils equal and react to light and accommodation. Eye grounds normal, no exophthalmus, extra-ocular movements normal. No palpable lymph-nodes. Tonsils appear to be negative. Chest asymmetrical, due to scoliosis. Breasts undeveloped. Lungs clear. Heart not enlarged; sounds of good quality. Liver and spleen not felt. Abdomen and extremities in general negative. All tendon reflexes active. Sensation was normal throughout.

FIG. 2. Case I. Osteitis fibrosa cystica involving the diaphyseal end of the left humerus. The epiphysis and periosteum are normal.

Roentgen examination, April, 1920. Roentgenograms were made of every bone in the body. The bones of the skull were normal. The sinuses, teeth and bones of the face showed no abnormalities. The cervical vertebrae were normal except for bilateral elongation of the transverse processes of the seventh (Fig. 1). The lungs were negative. There was a pronounced curvature to the right of the mid-dorsal verte-

brae. There were eleven normally developed ribs, the twelfth ribs being rudimentary. The vertebral ends of the ribs (Fig. 1) showed an expansion of the cortex, with longitudinal strands or striae of trabeculae enclosing very small cysts. The cortex was thinned but intact. The periosteum was not involved. Both humeri (Fig. 2) showed slight expansion and thinning of the cortex at the proximal ends, with rearrangement of the trabeculae into longitudinal strands enclosing small cystic areas. The periosteum and joint surfaces were not involved. The diseased condition extended into the epiphyseal lines but did not involve the epiphyses. The elbow joints were negative. The lower ends of the left radius and ulna (Fig. 3) showed marked expansion and thinning of the cortex, giving the ends of the bones a bulbous appearance. Longitudinal striae were pronounced, enclosing multiple cystic areas. Small cystic areas were also present in the cortex. The areas of decalcification gave the bone a mottled appearance. The periosteum and epiphyses were not involved. The ulna was considerably shortened, apparently due to the diseased condition having invaded the epiphyseal line. The carpal bones were normal (Fig. 3). The metacarpals (Fig. 3) showed the diseased condition at the diaphyseal ends. The phalanges showed similar changes to a lesser extent. Similar changes were present in the right forearm and hand (Fig. 3). Decalcification was more marked in the right ulna and a fairly large cyst was seen in the cortex on the outer side, giving the appearance of a blister. The cystic involvement was more marked in the right ulna, although the epiphysis was larger than the corresponding left side. The right ulna was also shortened and bowed slightly toward the radius.

FIG. 3. Case I. Osteitis fibrosa cystica, involving the bones of both hands, the right and left radii and ulnae. The disease extends into, but does not cross, the epiphyseal lines. Note shortening of the left forearm.

The lumbar vertebrae were normal except for slight rotation upon the fifth, to the left. There was slight evidence of the disease involving the pubic bones with slight separation of the symphysis. The upper ends of the femurs showed very slight involvement. The lower third of both femurs (Fig. 5) showed changes similar to those found in the humeri. The knee joints appeared normal. The diaphyseal ends of the tibiae and fibulae (Fig. 5) showed the diseased condition. The shafts were normal. There was no bowing nor thickening of the cortex. The weight-bearing lines were normal.

The tarsal bones were normal. There was slight involvement of the metatarsals similar to the changes found in the metacarpals. The tarsal phalanges were slightly involved.

Diagnosis. A diagnosis of generalized osteitis fibrosa cystica was made based upon the roentgenographic findings. A biopsy was not permitted.

Treatment. A plaster jacket was applied to the chest with a view to correcting the spinal curvature. It was thought advisable to remove by operation the fibrocystic areas in the distal ends of the ulnae, inasmuch as growth of these bones was interfered with,

but consent to operation was not obtained, The patient was instructed to avoid violent physical exercise or exertion of any kind that might cause fracture of the diseased bones. Aside from proper dietary and hygienic measures no further treatment was prescribed.

Subsequent History. The patient resumed her school work wearing the plaster jacket which was readjusted from time to time, and made no further

FIG. 4. Case I. Roentgenogram similar to Figure 3, made ten months later, showing fracture of the right radius and ulna. The fracture was caused by a fall while skating.

complaints until June, 1921, when she fell while skating, fracturing the right radius and ulna (Fig. 4). The arm was kept in a splint for six weeks, at which time roentgen examination revealed good union of the fragments. Roentgen examination three months after the injury showed practically no evidence of the fracture.

September 9, 1921. No additional complaint. Patient stated she was feeling very well and had attended school regularly. Weight 83½ lbs. (gain 11½ lbs.); height 60 in. (gain 6 in.); temperature 99; pulse 96; respiration 18; basal metabolism +2 per cent. Spinal curvature slightly improved. Calcium metabolic studies were suggested but could not be made due to lack of cooperation on the part of the patient.

September 30, 1922. Height 60½ in., weight 91 lbs. The left forearm and arm were 1 in. shorter respectively than the corresponding right extremity. She had no complaints except an occasional headache. The spinal curvature was slightly im-

FIG. 5. Case I. Roentgenogram showing lateral view of knee joints. Note absence of joint and periosteal involvement.

proved. Urine examination negative. No Bence-Jones bodies demonstrated. Blood—W.B.C. 5,300; R.B.C. 4,100,000; Polys. 47 per cent; S.L. 38 per cent; L.L. 7 per cent; Trans. 2 per cent; Eosin. 6 per cent.

Roentgenograms were again made of the entire skeleton. The condition had not progressed. There was definite evidence of healing of many of the cystic areas, revealed by an increase in the lime salts in the involved areas and increase in the longitudinal strands of trabeculae, and disappearance of the small cortical and medullary cysts. This was definitely noted in the radii and ulnae.

CASE II.[1] Male, aged ten, white; first examined on Sept. 7, 1920. He complained of weakness and limp in the right thigh and leg and inability to run well.

Family History. Unimportant.

Past History. Only child; was a seven-months baby and delicate until seven years of age. Had whooping-cough in infancy. Never had been robust. First walked at age of one and one-half years. Flat feet at one and one-half years of age. Wore brace three years. At four and one-half years there was a noticeable shortening of the right leg. Operated upon in 1916 on account of bone cyst in right tibia.

Physical Examination. Poorly nourished. Walks with a lateral swinging gait and limps on right side. There is an outward bowing of the legs and shortening of the right leg. Muscle resistance weaker on right side by one-fourth. Measurements: right thigh and leg 29½ in., left 30⅜ in. Motion in legs not limited. Reflexes normal. The general examination was negative.

Roentgen examination, Sept., 1920, showed fibrocystic areas involving the upper third of both femurs. The epiphyses and periosteum were not involved. The upper third of the shaft of the left femur was somewhat expanded, with thinning of the cortex, and the bone presented a mottled, honey-combed appearance. There was considerable outward bowing. The right femur showed similar changes, which involved the upper half of the shaft. The right ilium also showed a mottled cystic area about 2 by 2½ in. in size. The left fibula was curved inward and showed degenerative changes at the middle third. The periosteum was not involved. The skull was negative except in the right posterior parietal region, which showed a pronounced thickening and overgrowth of the cortex. Other bones of the body showed no evidence of the disease.

April 13, 1921. There was marked increase in the deformity of the femurs. On Jan. 14, 1921, he sustained a fracture of the left femur as a result of injury. Subsequently, on Feb. 12, 1921, while trying to walk with crutches he fell, fracturing the right femur. Both thighs were kept in

FIG. 6. Case II. Osteitis fibrosa cystica. Healed fracture of shaft of right femur. Note thickening of cortex on concave side.

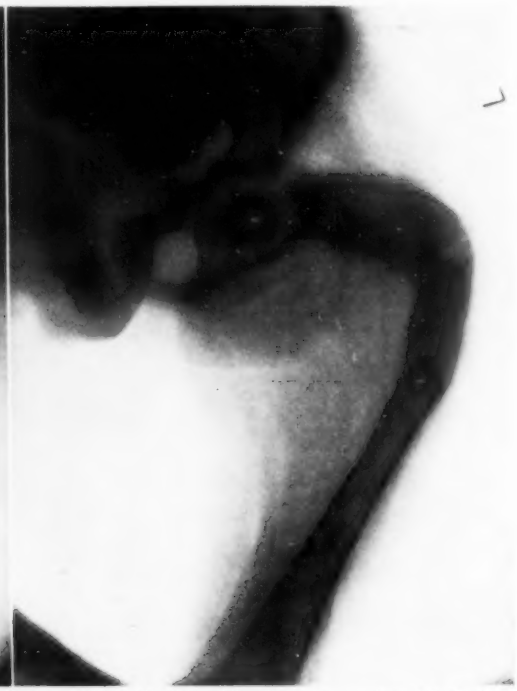

FIG. 7. Case II. Osteitis fibrosa cystica. Healed fracture of left femur with marked bowing of the shaft, giving the characteristic deformity resembling a shepherd's crook as described by von Recklinghausen.

[1] I am indebted to Dr. Chas. Venable, of San Antonio, Texas, for permission to use his records in this case.

splints for about six weeks. Roentgenograms of the left femur showed a fracture of the upper third. There was marked outward bowing and coxa vara. No evidence of callus formation or healing of the fragments was seen. The right femur was fractured at the middle third and also showed marked outward bowing and coxa vara. There was considerable callus formation around the ends of the fragments, indicating firm union. The fibrocystic changes in both femurs were as before.

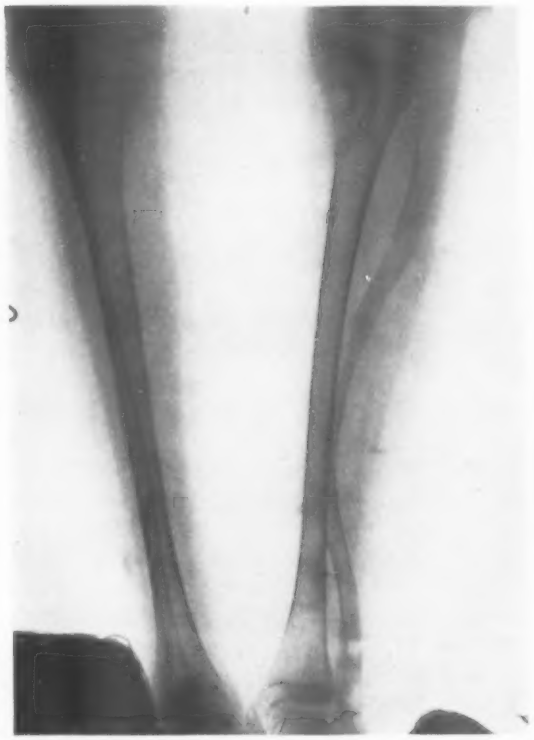

FIG. 8. Case II. Malacia and elongation of the left fibula. The fibrocystic changes in this case were most pronounced in the femurs.

Early in 1921 an open osteotomy was performed in the upper third of both femurs. The postoperative course was uneventful and the bones were considerably straightened by the operation.

Subsequent Examination. In March, 1922, there was great deformity of both femurs and the left fibula. Otherwise the patient had no complaints.

Roentgenograms of the right femur (Fig. 6) showed a marked outward bowing with coxa vara. The upper half of the shaft showed marked thinning of the outer cortex with cystic or degenerative areas scattered throughout the medulla. The inner cortex on the convex side is somewhat thickened. The entire bone appears less dense than normal, indicating absence of lime salts. The old fracture at the middle third has healed completely.

The left femur (Fig. 7) shows the upper third of the bone to be almost at right angles to the pelvis. The outward bowing and shortening of the shaft is very great. The deformed femur resembles a "shepherd's crook," the characteristic bowing as described by von Recklinghausen. The cortex on the outer or convex side is markedly thinned, whereas on the concave side it is somewhat thickened. No periosteal involvement was found. The old fracture in the upper third has healed completely. There was considerable deposition of lime salts throughout the old cystic areas, indicating healing of the diseased condition.

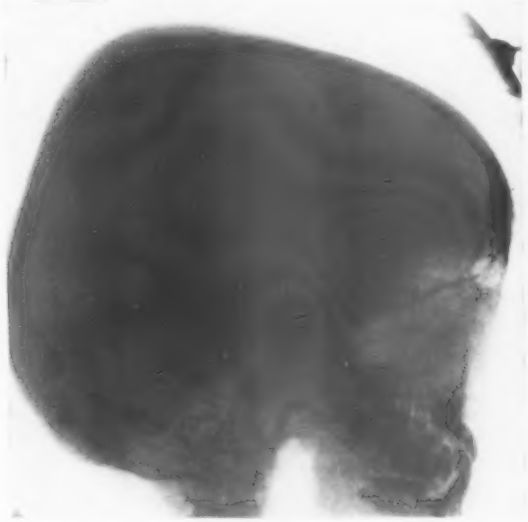

FIG. 9. Case II. Osteitis fibrosa cystica. Marked hyperostosis of the skull.

The left fibula showed a marked inward bowing, and thinning of the cortex on the convex side. The bone appears to be softened and too long for the tibia (Fig. 8).

The skull (Fig. 9) in the right parietal region shows a marked thickening or hyperostosis extending from the vertex

to the posterior border of the parietal bone.

It is interesting to note in this case the combination of the fibrocystic condition with osteomalacia of the left fibula and hyperostosis of the skull.

CLASSIFICATION OF THE DISEASE

There has been much controversy regarding the relation of the disease to multiple giant-cell sarcoma, Paget's disease and osteomalacia. Hirschberg first described the disease as a form of osteomalacia. Kalisco and other observers considered Paget's and osteitis fibrosa as identical. Latzko insists that pathological changes in the bones should not be considered purely from a morphological standpoint but that they should be differentiated according to their anatomic etiology. He states: "However similar Paget's, osteitis deformans and the osteitis deformans with tumor formation of Recklinghausen may be, they are nevertheless distinct processes." Hartman suggests that von Recklinghausen's disease and Paget's are not basically different but are even closely related, that is, they are to some extent modifications of the same pathological condition which for reasons still unknown to us, appear now in one form, now in the other.

Opinion is divided as to whether the localized form of osteitis fibrosa and the generalized form are or are not identical conditions. Slesinger states that it is difficult to hazard an opinion, because of the rarity of the generalized form and the lack of sufficiently long after-histories of the localized form; but such evidence as there is would rather lead one to believe that the two conditions are not connected.

The condition is generally classified as a benign fibrocystic bone disease. Albee places this group intermediate between the benign and malignant tumors, and states that many of the cysts partake of a sarcomatous nature while others are purely innocent. According to Ewing, after the bone tissue is replaced by fibrous tissue the disease takes one of two courses, namely, the formation of bone cysts lined by fibrous tissue and filled with clear fluid or the development of giant-cell sarcoma with cyst formation. Whether the cysts precede or follow the development of the sarcomatous process, is as yet undetermined. Morton states: "There is abundant pathologic and clinical evidence at hand now, however, firmly to establish the benign nature of these giant-cell growths. They grow locally only, do not metastasize, recur only on incomplete removal, and may be removed by local operation several times if necessary." Bloodgood has demonstrated that it is a safe procedure to remove primary or recurrent growths by surgical operation. The lesions heal and do not metastasize. This observation is borne out in one case reported in this article.

CLASSIFICATION OF TYPES

Morton divides the types or stages into two groups, and subdivides each group according to the degree of general malacia of the skeleton or hyperostosis of a portion of it.

Group I (Morton) Without giant-cell sarcoma.
- (*a*) With multiple cysts, fibrosis and malacia confined to a few bones.
- (*b*1) With multiple cysts, fibrosis and predominant general malacia.
- (*b*2) With multiple cysts, fibrosis, general malacia and hyperostosis.

Group II. With giant-cell sarcoma.
- (*a*) With cysts, fibrosis and tumors, but no marked malacia.
- (*b*1) With cysts, fibrosis and tumors and marked malacia.
- (*b*2) With cysts, fibrosis, tumors, malacia and hyperostosis.

He describes at length the character of the cases in each group and of the cases in the literature: 37 are placed in Group I; 22 in subdivision (*a*); 8 in subdivision (*b*1); and 7 in subdivision (*b*2). In Group II, 26 cases are classified: 16 in subdivision (*b*1), and 10 in subdivision (*a*) and (*b*2).

PATHOLOGY

The pathogenesis of the condition is not yet known. The pathological changes found, according to Whiteman, are due to an endosteal osteoplastic metaplasia.

The most extensive and important of these changes is a transformation of the bone marrow into fibrous tissue, mucoid or fatty material, or into another tissue of the same embryological type.

There is defective calcification of the bones with rearrangement of the normal trabeculae into longitudinal strands, enclosing multiple cysts. The cysts may vary in size, shape, and number and are lined by fibrous tissue usually filled with clear fluid. Opinions differ as to the origin of the cysts and giant cells which are usually present, although giant-cell tumor formation may not be extensive. Serous transudations which lead to liquefaction and hemorrhage in the tissues are thought to play the principal rôle in the first development of cysts in the region of the fibroma. Fraugenheim doubts that this theory can be generally applied and attributes to the fibrous-like formation, degenerative qualities which may cause extensive destruction, even vesicular swelling of the bones.

In the vicinity of giant-cell sarcomata Mockenberg always found an active lacunar bone reabsorption by osteoclasts, while in the periphery of the fibrous foci and the cystic fibroma there were evidences of excessive new growths of bony tissue.

Fujii found marked changes in the periphery of the affected bone. The bone was no longer compact but was broken up into cavities and irregular trabeculae. This change was particularly noted in the bones of the extremities. Volkman perforated canals were also found. Fatty marrow was present, rich in blood-vessels, dark red in color and replaced here and there by striated connective tissue in which newly formed bony tissue appeared. The cysts apparently developed in the peripheral substance by a fibro-osteomyelitic process. The presence of giant cells, according to Mallory, is evidence of a form of osteomyelitis, due to an irritative agent. This theory was also advanced by Fujii.

In children, if the disease spreads to the epiphysis, it is probable that growth of the bones, especially the long bones, will be affected and that shortening of the individual member may result. The disease appears not to invade the epiphysis proper and the periosteum is not directly involved in the diseased process.

ETIOLOGY

The etiology is unknown. The etiologic theories may be grouped under three headings: First, pathological disturbances in calcium metabolism, in which there is an excessive withdrawal of calcium (halisteresis); second, endocrine disturbances; and third, infectious agents.

As regards the calcium deficiency, it has been shown experimentally that by feeding a diet poor in calcium the consistency of the bones may be greatly reduced, until they are easily cut or broken. This occurs in rickets and osteomalacia. However, in the disease conditions whose causation is obscure in addition to the osteoporosis, which may be produced experimentally, there is production of osteoid tissue and other complicated histological changes. These changes described by MacCallum are considered to depend upon chemical alterations and the power of the freshly produced tissue to alter the form of the dissolved calcium.

Thus the excessive withdrawal of calcium in osteitis fibrosa may be the result of a general chemical disturbance associated with the destructive bone changes.

Insufficient findings are at hand to attribute the cause of the disease to a disturbance of the internal secretions. Lotsch, however, could find no other supposition that proved tenable. In the cases studied by him, syphilis or evidence of other infectious agents were not found. No microorganisms have been found that can be held responsible for the disease in any of the cases studied.

DIAGNOSIS

Diagnosis is made from the characteristic roentgen-ray findings and the history of pain in the joints and extremities of a rheumatic nature, fracture as a result of some trivial injury, and deformities, such as bowing and shortening of the long bones. The condition must be differentiated from osteomalacia and Paget's disease. In the latter diseases the history of the onset,

characteristic deformities and roentgen-ray findings should make the diagnosis of these conditions fairly easy.

ROENTGEN-RAY FINDINGS

There is an expansion of the bones without thickening of the cortex. The periosteum is not involved, except where fractures have occurred. Small cystic areas are seen scattered throughout the cortex and the bony structures are replaced by irregular strands of trabeculae enclosing multiple cysts which vary in size and shape. The bones have a mottled appearance, due to the cystic areas and absence of calcium salts. The cortex is usually markedly thinned and may be destroyed. The process does not involve the epiphyses. Lesions occurring in the region of the epiphyseal lines may cause shortening of the bones due to interference with growth. There is absence of periosteal involvement. Hyperostosis may be seen in the cranial bones, resembling Paget's disease, but there is no roughening of the periosteum and marked subperiosteal cortical bone thickening, especially in the tibiae, as found in Paget's disease.

TREATMENT

Nothing is known that will arrest the course of the disease. Cases treated medicinally with phosphorus, calcium, arsenic, and glandular extracts have shown no apparent improvement. Operative procedures may be instituted in the treatment of the fractures and removal of the fibro-cystic areas. However, removal of the cystic areas in all the affected bones can seldom be accomplished, on account of the general distribution of the disease. At the site of fractures and where the fibro-cystic areas extend into the epiphyseal lines interfering with growth of the bones, operative removal of the cystic areas is indicated. Young and Cooperman treated a patient with radium and roentgenotherapy without any effect upon the course of the disease.

The disease may run a course of a few months or may be present for many years. Death usually occurs from cachexia or intercurrent disease.

CONCLUSIONS

1. Generalized osteitis fibrosa cystica is classified as a benign fibrocystic bone disease of rare occurrence. Its etiology and pathogenesis are unknown.

2. The disease presents the following characteristics:

(*a*) Insidious onset with slight subjective symptoms or absence of them, usually occurring during the epiphyseal age period.

(*b*) Involves all bony structures. The epiphyses and periosteum are not primarily involved.

(*c*) Transformation of the bone-marrow into fibrous or osteoid tissue, decalcification of the bones with cysts, giant-cell tumor formations, osteomalacia or hyperostosis of the affected bones.

(*d*) Bony deformities, resulting from pathological fractures, hyperostoses, bowing or softening.

(*e*) Benign in character; lesions do not metastasize and may be removed by operation.

(*f*) Spontaneous healing of the cystic areas, especially where fractures have occurred.

(*g*) Chronicity; the course is of long duration and the progress slow.

3. The roentgenographic appearance of the diseased bones is typical.

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CHONDROGENESIS IMPERFECTA-ACHONDROPLASIA-CHONDRODYSTROPHIA FETALIS*

With a Report of 6 Cases and 1 Operation

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NOMENCLATURE

Achondroplasia (Parrot) or absence of cartilage is not so accurate a term as chondrodystrophia fetalis (Kaufman) which signifies abnormal development of cartilage. Osteochondrodystrophia fetalis is a better term than chondrodystrophia fetalis. Other terms used in describing this condition are dwarfism, fetal rickets, congenital rickets, fetal cretinism (Horsley, Virchow), pseudorachitism, pseudorachitis fetalis, micromelica, cretinoid dysplasia, chondritis fetalis, cartilaginous dysplasia, nanism, micromelia and chondromalacia.

One of the writers, (P. L.) suggests a name corresponding with the descriptive term osteogenesis imperfecta, i.e., chondrogenesis imperfecta, or osteochondrogenesis imperfecta.

HISTORICAL

Dwarfs were recognized in ancient history as sacred beings—idols, to be worshipped. During the middle ages the most prominent rôle these individuals played was that of court jester; they were valued for their precocity and eccentric appearance. In modern times they have been conspicuous as actors, mirth-exciting and abnormally strong as compared with their size. They are found in all circuses or "side-shows." Many nobles have had them as mascots.

The figures of the gods Phthah and Bes in ancient Egypt were dwarfs as were those in the canvasses of Velasquez in more recent times.

The most important contributions to the literature on this subject have been made by Kaufman, Jansen, Marie, Apert, Cestern, Gilford, Porek and Durante, Emerson, and Rischbieth and Barrington.

ACHONDROPLASIA IN ANIMALS

The most striking example is that of the dachshund. Others are the pug dog,

* Read at the Twenty-fourth Annual Meeting of The American Roentgen Ray Society, Chicago, Ill., Sept. 18–21, 1923. This paper is based on the observation, and in some cases the intimate study, of 13 real dwarfs and 59 midgets.

guinea pig, Ancon sheep, Nato's cows of Chili, Yorkshire pigs, and the bull-dog calf; the last named having a very short snout, short legs and thick wrinkled skin, but normal development of the short bones.

There was very recently at the Hotel Pennsylvania in New York City, a baby hippopotamus, shipped from Hamburg under the personal direction of Heinrich Hagenbeck. It belongs to a rare tribe of pygmies of which there are only five in captivity. Two of these are in London and two in Bronx Park, New York. It is perfectly formed and at the age of eighteen months is but 28 in. in height and weighs only 126 lbs. When it reaches its full growth at the age of two and one-half years, it will weigh not more than 250 lbs. as contrasted with the 3,000 to 3,800 lbs. usual for a normal adult hippopotamus. The valuable young animal is very delicate and requires the most painstaking of care. Accompanying it as caretaker is an animal expert who attends it day and night. The animal is never uncovered for a moment lest it take cold, and its daily regime includes a bath and carefully supervised feedings. It is very gentle and affectionate, a perfect pet.

In the vaudeville troup known as Singer's midgets, there are midgets of the following animals: pony, monkey, elephant and Pekinese dog.

ETIOLOGY

The etiology of chondrodystrophy is a subject of discussion; the most probable explanation is that of Mürk Jansen of Leiden, Holland. He believes that all the symptoms can be explained by the assumption that the amnion, remaining too small, enhances the normal infolding of the embryo in the fifth or sixth week of embryonic life; that it, at that time, increases hydrostatic pressure inside of the amniotic sac and squeezes the blood out of the fetus during the formation of its cartilaginous skeleton. Some writers criticize this theory on the ground that if it were due to pressure there should be transitional stages. The writers believe there are transitional stages and have grouped them under the term pseudo-dwarfs.

Other theories are the glandular, the metabolic, the rachitic and the infectious.

Wagner put forth the theory that dwarfism is due to premature inhibition of cartilaginous growth by excessive gonad hormones, i.e., dwarfs are the opposite of castrated or eunuchoid individuals. The gonad secretion controls the closure of the epiphyses. Engelbach and Tierney believe it is possible that a hypergonad secretion allows early ossification and decreased growth of long bones. In hypogonadism the inhibitory effect of the gonads is missing and the long bones over-grow.

Sex does not seem to be a factor.

Society is a very important factor in view of the fact that practically all cases are among the poor class.

Heredity is probably a negligible quantity.

Color. The literature consulted revealed but one case among negroes. Elliott states that Christopherson presented the skeleton of an achondroplastic negro to the museum in London. If rickets were an important factor, one would expect to find achondroplasia commonly among negroes which race furnishes much of the rickets encountered. However, dwarfism is very rare among the colored race. (The writers have seen two colored midgets, one of whom was born in Java.)

BASSOE'S CLASSIFICATION OF DWARFS

1. Proportionate dwarfs
   (*a*) Primordial dwarfs (essential microsomia)
   (*b*) Hypophyseal dwarfs
2. Disproportionate dwarfs
   (*a*) Achondroplasia (chondrodystrophia fetalis).
   (*b*) Stunting of growth from rickets or Pott's disease
   (*c*) Cretinism
   (*d*) Congenital syphilis

HASTINGS GILFORD'S CLASSIFICATION

1. Racial or Phylogenetic dwarfism
2. Ontogenetic or individual dwarfism
   (*a*) Primary or essential
   (*b*) Secondary or symptomatic

PATHOLOGY

The pathological process begins in fetal life and consists in a disturbance of the normal ossification of primary cartilage. It is a dystrophy of the epiphyseal cartilage. It affects endochondral ossification only, never the intramembranous type except in severe cases. The bones of the extremities are, therefore, usually affected, while those escaping are the vault of the cranium, superior maxillae, malars, nasals, lachrymals, palate bones, vomer and internal pterygoid plate.

FIG. 1. Case I. Before operation.

FIG. 2. Case I. After operation.

According to Adami and Nichols, growth in the length of the bones is seriously interfered with, due to faulty ossification at the epiphyseal lines, but periosteal ossification is practically normal, with the result that the bones become short, plump and thick.

Kaufman Types:

1. Chondrodystrophia malacia
2. Chondrodystrophia hypoplastica
3. Chondrodystrophia hyperplastica

In Type 1 the cartilage at the ends of long bones is to some extent increased in size, but no columns of cartilage cells are formed. The cartilage in places is softened and in others is irregularly ossified.

In Type 2 ossification of cartilage is diminished, the columns of cartilage cells are small, the cells themselves are deficient in growth, being spindle-shaped, irregularly arranged, and having the appearance of being compressed. The hyaline matrix is more or less soft and homogeneous.

In Type 3 there is marked overgrowth of cartilage leading to notable thickening at the epiphyseal ends of the bones. Ossification is extremely irregular. These types may be different phases of the same affection.

Skull. The skull shows the characteristic depression at the base of the nose, causing a "pug nose." The vault of the skull is very large and round, showing a thinning of the bones. The skull tapers at the base. This is due to the ossification of the sutures at birth. The sutures in

the vault ossify late, because of the increased intracranial pressure. The early ossification of the basal sutures causes a narrowing of the base, which, in turn, causes the compensatory expansion of the vault. With this there is a delay in the ossification of the fontanels. The obliteration of the cartilaginous fissure of the skull in utero causes a deficient linear development of the base, which in turn leads to a marked depression at the root of the nose.

Fig. 3. Case II.

Fig. 4. Case II. Typical hand deformity.

These factors are the cause of the diminution of the angle and the decrease in size of the foramen magnum. That portion of the base of the skull formed by the occipital and sphenoid bones, the "os tribasilaris" consists at birth of three pieces, the basilar portion of the occipital bone and the pre- and post-sphenoid bones. The synchondrosis intersphenoidalis unites at about the time of birth. But the cartilage uniting the sphenoid and occipital bones is not solid until about the eighteenth or even the twenty-fifth year. "On the existence of this cartilage depends the development of the base of the skull, and therefore, the brain" (Virchow).[9]

In the achondroplastic stillborn infant these bones are often firmly united, and the clivus deprived of the possibility of growth in length. This was noted by Sartorius in 1826. The clivus is in these cases abnormally vertical ("Kyphosis of the Skull" Virchow). This shortening of the base of the skull from 7.6 cm., the normal, to 4.6 cm. or even less, explains, according to Virchow, the depressed root of the nose.

The receding upper jaw is quite evident when compared with the prognathous appearance of the lower jaw. Here again the basal kyphosis is the cause. The sella turcica is very dense, having the appearance of sclerosis. The pituitary fossa is shallow and narrow.

Chest. In comparing the normal with an achondroplastic thorax, one is impressed with the loss of the curve of the ribs. The ribs posteriorly are straight. The chest is broader than normal. The ends of the

ribs are greatly widened and flaring. The clavicles are straight, the normal curve being lost.

There is no evidence of a rosary, as seen in rickets. There is no change in the lungs. The area of density along the sternum, so frequently seen in rickets, is not present in achondroplasia.

Spine. The entire spine shows a great many changes. The bodies are compressed. The articular surfaces are very irregular. The intervertebral spaces are greatly increased. (The liver is much enlarged.) The sacroiliac joints are widely separated. The sacrum is rarefied.

Pelvis. The pelvic outlet is greatly decreased. The obturator foramen is greatly enlarged. The acetabulum is eroded. The articular surface is very irregular. The head of the femur is not developed. The neck is very irregular. The greater and lesser trochanters are normal.

FIG. 5. Case I. Ankle region showing epiphyseal changes.

Femur. The shaft of the femur is curved forward and backward, and greatly shortened. The bowing is more pronounced in the lower third. The cortex of the bone is greatly thinned. The diaphysis of the femur is thickened, with considerable flaring. The pathological process involves both the epiphyses and the diaphyses. The epiphyses are irregular and very porous. The articular surface of the lower end of the femur is very irregular.

Tibia and Fibula. The epiphyses of the tibiae and fibulae are very irregular and are "mushroomed." The epiphysis is partially destroyed. There are a great many areas of rarefaction in the bone.

Foot. The bones of the foot are porous. The osteoporosis is not like that usually

FIG. 6. Case I. Hand and wrist.

seen resulting from atrophy. The Haversian canals are very prominent, giving the bone a streaked appearance. The bones are soft, with areas rich in calcium salts—trabeculae. The cortex is usually thin. The articular surfaces are very irregular. Some of the bones of the foot are not developed, such as the navicular, cuboid and cuneiform.

Hands. The hands are short and broad. The fingers are about the normal length. The middle and ring fingers often become

separated from each other at the ends. The fingers form three groups: (1) the thumb, (2) the index and middle finger, and (3) the ring and little finger—the so-called "trident hand." (A trident is a three-pronged and a bident is a two-pronged fork or harpoon.)

FIG. 7. Case I. Epiphyseal changes at elbow and shoulder.

The metacarpal bones form a semicircle, coming off the carpals like the spokes of a wheel. The carpal bones are irregular in outline and small, due to a delay in ossification. The proximal row of carpals seems more extensively involved than the distal. The metacarpals are short and their epiphyses are broader than normal.

SIGNS AND SYMPTOMS

The cardinal sign of chondrodystrophy is the disproportion between the body-length and the length of the extremities, i.e., the body-length is normal and the arms and legs are very short. A dwarf erect is analogous to a dachshund standing on his hind legs. The late J. B. Murphy used to say he was "a dog and a half long and half a dog high."

The center of the body is displaced downwards, i.e., the umbilicus is below the transverse mid-line of the entire individual. After one year of age the umbilicus should be half-way between the head and feet. The head is large, the vault is large, but the base is short. The expression is alert and humorous. The bridge of the nose is depressed—"pug-nose." There is an excess of fat and skin which hangs in folds. The skin seems too large for the body.

The arms do not reach down as far as normally. The hands are short, chubby and flabby, the fingers are nearly all the same length, giving the hand a square shape. The ends of the fingers are separated as though wedges were inserted at the roots. "(Main en trident" or three-pronged fork of Marie. "Main en bident" or two-pronged fork.) The phalangeal epiphyses are large. The angle subtended by the second and fifth metacarpal shafts is about 40° instead of the normal 32°.

There may be flexion deformities at the hips, knees and elbows, as shown in Case I of this report. Limitation of extension of various joints may be common. In Case I there is possible hyperflexion of the elbows but limitation of abduction at the shoulders and hips.

The abdomen is prominent and there is an exaggerated lumbar lordosis. An arcuate kyphosis may be present. If rachitic, the usual signs of that condition are present. According to Philip Hoffman the acromial end of the clavicle is lower than the sternal end, i.e., the reverse of normal.

Muscle weakness is usually very great during infancy, childhood and adolescence. After adult life is reached it may give way to great strength (especially in proportion to size).

Sexual powers are usually normal or

increased. If pregnancy occurs, a Caesarian section is necessary because of the deformity of the pelvis. (Cretinoid dwarfs are usually sterile.)

Mentality is below normal, but far from imbecilic. They are good-natured.

Dentition is slightly delayed.

Walking is usually delayed until the third or fourth year.

FIG. 8. Case III. Practically entire skeleton.

Jansen states that achondroplasia and dysostosis cleidocranialis are often associated with other congenital malformations such as spina bifida, congenital club-foot and many others. Achondroplasia has been observed to be attended by mongolian idiocy as the latter is constantly accompanied by symptoms of achondroplasia (Van der Scheer).

ROENTGEN-RAY FINDINGS

The roentgen findings in most cases of achondroplasia are quite characteristic and are readily recognized. There are, however, a number of bone diseases encountered in which the roentgen findings are quite similar to achondroplasia, and only after a thorough study of the films and the careful taking of a clinical history can a diagnosis be made in some cases.

Achondroplasia involves especially the epiphysis and the epiphyseal cartilage, and thus, usually from these changes, a diagnosis can be made. The interference with the epiphysis leads to a much retarded growth, and oftentimes complete arrest of development follows. The disease is not confined to any or to any one group of bones. Practically the entire osseous system may be involved. The bones formed in membrane usually escape except in the very serious cases. The bones formed in cartilage are affected to a degree determined by their formation, the earliest formation being affected the least, the latest, most. The

most common location is, however, in the ends of the long bones, and it is here that the changes are quite typical. The ossification at the epiphysis seems to occur at an early date, and it is not uncommon to see complete fusion of the epiphysis in a very young child. The ends of the bones become very dense, and in many instances broadened, showing a very marked flaring. The periosteum seems to show no changes, consequently bone is not laid down in excess, and as a result, very little widening of the shaft is noted.

In comparing the normal thorax with that of an achondroplastic, one is impressed with the loss of normal curve of the ribs in the latter. The ribs, instead of extending downward and forward, are practically straight. The chest is much broader than normal, and the ends of the ribs are widened, and show a marked flaring. The clavicles are straight, the normal curve being lost.

There is no evidence of a rachitic rosary and the areas of increased density seen along the sternum in rickets are not present in achondroplasia. The spinal column shows a great many changes. (It is not uncommon, however, to find the spine unaffected.) The bodies are narrowed, rarefied and very irregular. The narrowing of the bodies leads to a widening of the intervertebral spaces. The articular surfaces of the bodies are irregular and thickened. The normal curves of the spine may not be greatly exaggerated. In comparing the sacroiliac joints there seems to be a great widening of the joints with a roughening of the cartilaginous surfaces. The sacrum is rarefied, but shows complete development of all segments.

The general anatomy of the pelvis is quite striking when compared with the normal. The size of the outlet is greatly decreased while the obturator foramina are enlarged. The general appearance of the bones leads one to believe that they are soft and decalcified. The heads of the femora are not developed and the necks are located in the shallow acetabular cavities. The greater and lesser trochanters are as a rule quite normal. The femora are very short and there is a decided anteroposterior bowing, the latter especially in the lower third. The general appearance of the cortex is quite characteristic in that there is a very noticeable thinning.

In the distal diaphyses of the femora there is a definite thickening, band-like in structure, which seems to block any further growth. At this region there is flaring and widening of the bones. The epiphyses are poorly developed, irregular and porous, and the articular surfaces are exceedingly rough. In the very advanced cases there may be great distortion of the femora. As early as 1906 Freiberg described and showed a roentgenogram of the hip of a typical chondrodystrophic dwarf. The distal ends of the tibiae are widened and have a mushroomed appearance. The epiphysis is only rudimentary. Throughout the tibia are many small areas of bone rarefaction. There is a very definite band of thickened bone at the distal end of the tibia. The fibula is usually too long for the tibia. The head reaches to the knee while the external malleolus extends too low down. Throughout the bones of the feet there is a generalized osteoporosis, which is unlike that which commonly follows atrophy of disuse. The Haversian canals are very prominent, giving the bones a streaked appearance. The bones seem soft and are spotted with many small areas rich in calcium. The cortex of the bones is unusually thin. The articular surfaces of the tarsal bones are very irregular. The centers of ossification of the bones of the foot appear very late, and in one case, at the age of fourteen the navicular, cuboid and cuneiform had not appeared.

The hands are quite characteristic, the metacarpals being short and broad. The phalanges are normal in length. The middle and ring fingers often become separated from each other at the ends. The fingers are formed into three groups: (1) the thumb, (2) the index and middle and (3) the ring and little finger. This is the so-called "trident hand."

The metacarpals form a semicircle coming off the carpals like the spokes of a wheel. The carpal bones are irregular in outline and small, due to the cartilaginous changes and their late appearance. The proximal row of carpal bones seems more extensively

involved than the distal. The metacarpals are short and their epiphyses are broader than normal.

DIAGNOSIS

Direct Diagnosis. There should be no difficulty in making a diagnosis of chondrodystrophia fetalis. Whether the subject is seen immediately after birth or several years later, the disproportion between the normal length of the body and the short arms and legs determines the diagnosis. The large vault of the cranium, depressed bridge of nose, abnormal folds of skin and fat, especially of the lower extremities, deformity of the hands, weakness of muscles and roentgenologic findings are corroborative.

Differential Diagnosis. Between the types of dwarfing. The various kinds to be differentiated are as follows:

1. True chondrodystrophia fetalis, in which no definite etiology is suspected.

2. Cretinoid type in which the evidence of cretinism is marked, i.e., typical facies, thick tongue, mouth breathing, dry skin, straw-like hair, mongolian eyes, deficient mentality, etc.

3. Hypophyseal type, as evidenced by changes in size and shape of sella turcica and disturbed carbohydrate metabolism.

4. Pluriglandular type, in which one is impressed with the glandular element, but the specific gland cannot be determined.

5. Rachitic type, in which the cardinal signs of that disease are present, viz., enlarged epiphyses, square forehead, delayed closure of fontanelles, rachitic rosary, Harrison's groove, flared costal borders, pot-belly and lumbar lordosis. There is no reason why a true dwarf may not develop rickets as well as an ordinary child, the rachitic condition being entirely a secondary affair.

DIFFERENTIAL DIAGNOSIS

1. *Rickets* is a disease of very early childhood, especially during the first two years. It involves especially the epiphysis. The saucer-shaped epiphysis is quite characteristic of rickets. The joint is intact. Fractures are apt to occur in rickets, and are very rare in achondroplasia. The two conditions are, however, often associated. Other evidences of rickets are the enlarged epiphyses, bone deformities such as genu varum and valgum, pigeon breast, square forehead, rosary, etc.

2. *Syphilis.* Hereditary syphilis also occurs in the very young, usually during the first two years of life. The joint is intact, and the epiphysis and epiphyseal line are normal. Syphilis attacks the ends of the diaphyses, showing small irregular areas of rarefaction. Periostitis, periarticular swelling and fluid are usually present in syphilis, and absent in achondroplasia. Swelling of the joint is often present in congenital lues. Joint involvement is usually multiple. Syphilis is not so extensive as achondroplasia, only a small portion of the bone being involved. The Wassermann reaction and anti-luetic treatment are of great diagnostic value.

3. *Osteogenesis Imperfecta* (Lobstein's disease). The changes in osteogenesis imperfecta usually occur in the shafts of the bones, the joints being uninvolved. Fractures may be numerous, which condition is rare in achondroplasia. There is a general decalcification of the bones, making it difficult to obtain a good roentgen film. The differential point lies in the fact that in osteogenesis imperfecta, the epiphyses are intact, while in achondroplasia the gross changes are in this area. Osteogenesis imperfecta is differentiated by the multiple fractures of the long bones, history of pathological fractures and the normal proportions of body and extremities. The two conditions are sometimes associated.

4. *Cretinism.* The condition which is frequently to be differentiated from achondroplasia is cretinism. The differential diagnosis between achondroplasia and cretinism may be impossible from the roentgen-ray evidence alone. The careful taking of a history with the usual findings of cretinism or dwarfism is necessary to differentiate the two diseases.

5. *Scurvy* is a disease of early childhood. The joint in scurvy is normal. The pathology is located just behind the epiphyseal line. At this area a destructive zone is located (Trommer's zone). In scurvy subperiosteal hemorrhages are prone to occur, which is not true in achondroplasia. Pain and sensitiveness to jarring may be extreme

in scurvy. The changes in scurvy are less general and usually respond miraculously to treatment.

Osteomalacia is a disease of late life, whereas dwarfism is a condition found in infancy. Osteomalacia affects the shafts of bone, whereas chondrodystrophia disturbs the epiphyses chiefly. Osteomalacia is very rare in males; chondrodystrophy is as frequent in males as females.

Hydrocephalus should be distinguishable without much difficulty.

Midget. In this group belongs the most interesting class of small people. What differentiates a midget from a dwarf? The answer is very simple. The definition of Brennemann is perfect, viz., "A midget is a man or woman looked at through the wrong end of the opera glasses." A midget is of normal form, but diminutive. A dwarf is a disproportioned or deformed individual.

PROGNOSIS

The prognosis as to life is only fair. Most dwarfs are stillborn. Of those born alive, the majority die soon after birth or in early infancy. Those who survive frequently live to a great age. The chances of reaching normal height are hopeless. Rarely do they grow taller than 3½ or 4 ft. If adult life is attained, the acquisition of unusual strength in proportion to the height is quite common. Where contractures and deformities are present it is necessary to continue orthopedic treatment of correction and retention for many years, i.e., until all tissues involved have assumed a permanent condition.

TREATMENT

The treatment varies with the individual case and is rather simple when the type of deformity is differentiated.

Cretinoid Types. If one has a cretinoid type to deal with, the administration of thyroid by mouth in doses ranging from 1/10 to 5 gr. three times daily is indicated. (It has for several years been the desire of one of us (P.L.) to transplant into some such location as the abdominal wall of a cretin, a lobe of human thyroid, which might save the continued giving of the gland by mouth.)

In the *rachitic type*, heliotherapy plus an anti-rachitic diet should be prescribed, emphasizing the importance of fresh fruit juices, fresh vegetables, mixed diet, containing vitamines, crisp bacon, etc., and the internal administration of phosphorus and cod-liver oil, in a mixture as follows:

Phosphori gr. 1/6
Olei Morrhuae ℥ii.
M. et. ft. sol.
Sig. ℥ i t.i.d. a.c.

Phosphorized cod-liver oil is excellent because the dosage is reliable.

Hypophyseal Type. If it can be definitely demonstrated that the sella turcica is unusually small and therefore the hypophysis probably undersized, there is an indication for the intensive administration of hypophysis gland by mouth and hypodermically. If toxic symptoms develop, one-half the dose may be continued as a physiologic dose or the gland withdrawn temporarily and another substituted. A small-sized sella may be very misleading and does not always indicate hyposecretion of the hypophysis. (Engelbach and Tierney.)

Pluriglandular Type. For those cases which are thought to be of glandular origin but definitely non-cretinoid, the internal administration of various glands successively is a matter of hit or miss, but a method that should be tried. It is advisable to alternate for periods of two months each with various glands, as follows: For a child of ten years, anterior lobe of hypophysis, gr. 5; Pineal Gland, gr. ½; Thymus Gland, gr. 5; Thyroid, gr. 2. Each gland should be given three times daily and untoward effects watched for carefully.

Orthopedic treatment of contractures and deformities consists in correction and retention. The treatment given the case below is an illustration. It must be continued over long periods in order to prevent recurrences and occasionally controlled by roentgenologic study.

Case Report: Male, white, aged thirteen, of Swedish parentage, a pupil at the Fallon School for Crippled Children. Entered St. Luke's Hospital Oct. 2, 1919, on the service of Dr. John L. Porter. He was brought to the hospital to have

"bow-legs" corrected. As a baby, he seemed to be normal. He was always heavy. Began to walk at nine months but very soon became ill and did not resume walking until eighteen months old. At the age of four years his parents noticed his arms and legs were not developing as rapidly as his body, and as he increased in weight his legs became "more bowed." The length of arms and legs has not increased perceptibly since he was four years old. He is weak, and cannot walk any distance as compared with other children. He is alert, responsive and in the fifth grade at school. Had scarlet fever, tonsillitis, diphtheria, chicken-pox, whooping-cough and the above-mentioned illness at nine months of age. His mother is of normal size and in good health. Her health during pregnancy was very good. His father was a normal-sized man. Two sisters, aged sixteen and eleven, and one brother, aged four, are of normal development and health.

Physical Examination. Patient is an undersized boy, 38½ in. in height. His body is of normal length, but his arms and legs are very short. Walks without aid but has a waddling, shuffling gait. He stands in a peculiar attitude with marked lumbar lordosis, prominent buttocks, flexion of thighs and knees, and varus position of feet. Flexion of elbows with increase in carrying angle (cubitus valgus). Marked weakness of entire musculature.

Head: greatest circumference 21 in.; fontanelles closed; hair, thick, fine and light brown in color; scalp, normal; eyes, reflexes normal, appearance normal; ears, normal. Mouth, molars carious. Throat, tonsils hypertrophied and hyperemic. Neck: glands; posterior cervical group palpable, upper anterior cervicals palpable. Thyroid palpable but not enlarged. Chest: diameter; angle of the scapulae and nipple line 25 in. Expansion ½ in.; heart, negative; lungs, negative; lower costal margin flaring and prominent; Harrison's groove present. Abdomen, negative. Back, marked lumbar lordosis.

Arms: length from posterior angle of acromion process to tip of index finger, 15¼ in. There is a groove to admit the tip of the index finger between the tip of the greater tuberosity and the acromion process. The arms can be raised only to the level of the shoulders. The forearms extend only to an angle of 45°. Wrist joints large, i.e., lower epiphyses of radii and ulnae enlarged. Hands are wide for the length, stubby, flabby. Main en trident. Hands are very weak. Epiphyses of phalanges very thick.

Lower limbs: In erect position thighs are flexed to an angle of 45°. These cannot be extended. Tibiae are curved outward, the curve being most prominent in the lower third. The external malleoli are large and prominent due to enlargement of epiphyses.

Feet: length from heel to tip of second toe is 6¾ in. Width at widest portion is 3¼ in. There is a partial syndactylism of the second and third toes of each foot. There is bilateral equinovarus.

Roentgen-ray Findings: sella turcica very small and especially so in proportion to the size of skull.

The parents were given very little encouragement and were told it was probable that 1 or 2 in. might be added to the boy's height. They were willing to try anything. He was put to bed and Buck's extension applied to both legs. After one week without improvement he was given ether and operated upon (P.L.) on Nov. 10, 1919. Over the foot of the Hawley table a great deal of force was used, the knee flexion and various deformities were corrected and plaster casts applied with knees extended and the feet in slight valgus Then using the legs encased in casts as long levers with the buttocks held down, the hip flexion was forcibly overcome and a double plaster of Paris spica applied from above the costal margins and joined to the leg casts. He had no trouble whatever in taking the ether and no pain following the operation. This cast was removed at the end of five weeks. Measurement of his body length showed 42 in., an increase of 3½ in. in five weeks. November 10, 1920, one year subsequent to operation his length was 42⅜ in. Because of his inability to walk it was deemed advisable to apply simple leg and foot casts and to recommend crutch locomotion. After about four weeks one leg cast was removed and a single spica of the hip applied to that side. Six months

after operation all casts were removed. He was given anterior lobe of hypophysis 2 gr., three times daily. Massage, active and passive motion and stretching of arms and legs (but not of the body) were given by a nurse from the Visiting Nurses Association. He was instructed not to sit down much, because of the danger of recurrence of hip and knee flexion deformities, but should spend most of his time standing or walking with crutches, or lying down. The further treatment will consist in alternating the hypophysis with pineal gland, thymus and thyroid, the occasional application of a leg or hip spica and infrequent examinations by the roentgenologist.

BRIEF SUMMARY

A midget is a man or woman looked at through the wrong end of the opera glass, that is, diminutive but not deformed. Dwarfism (chondrodystrophia fetalis) is a condition of abnormal fetal development of cartilage. It occurs in lower animals also. The most probable theory of its etiology is that of Jansen, i.e., that a small amnion increases the normal embryonic infolding and hydrostatic pressure during the fifth or sixth week of fetal life, resulting in feebleness of growth of the rapidly growing cartilage cells. The cardinal sign is the disproportion between the normal length of body and the short extremities. There is an excess of skin and fat in folds, "pug-nose," and the hands are short and chubby with fingers of nearly equal length coming off the metacarpals like spokes of a wheel. Prominent abdomen and exaggerated lumbar lordosis are almost constant. The roentgenologic evidence is most marked in the epihyses and epiphyseal cartilages, especially of the long bones. The periosteum seems to show no change.

In conclusion we desire to express our sincere thanks to Dr. John L. Porter for his kindness in permitting us to report this case and for his helpful suggestions in its treatment and supervision.

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DISCUSSION

Dr. L. T. LeWald, New York. Dr. Stockton, Professor of Anatomy of Cornell, brings out the point that for certain individuals this type of stature and conformation is just as natural as a pug dog is for his species. Stockton says that there is no question that a complete race of individuals of this type could easily be produced.

I think the point is well brought out that these individuals may suffer from deformities and disease, just the same as any other individual, and one must not overlook the correction of the deformity in an individual of this type.

Dr. P. M. Hickey, Ann Arbor, Mich. I was very much interested in this subject. We have recently had a case of pregnancy which was allowed to go on to the sixth month. It was in the service of our obstetrical department, and the case was roentgenographed several times from the standpoint of obtaining the position of the fetus, but at the same time we had ample opportunity to make studies of the long bones. It was exactly of the type that the doctor has described, and the pregnancy had to be interrupted at the sixth month.

Dr. Lewin (closing). There is such a thing as racial dwarfism. In one of the classifications that I did not read, Gilford mentions the racial and the phylogenetic dwarfs.

The point that Dr. Hickey brought out is very interesting. I would be interested in seeing the position of that fetus. Mürk Jansen believed that the amnion, being small, enhanced the normal infolding of the embryo, and that this occurred between the fifth and sixth week of intrauterine life. It was just at that time that these cartilage cells had their most rapidly growing period, and he believes it was just at that time that the increase of hydrostatic pressure squeezing blood out of these cells, caused this condition.

Concerning heredity, Jansen shows many series of entire families, showing that the first child seemed normal, but that farther along, to the seventh or eighth child, when the mother probably had been exhausted, she gave birth to a child that had this condition. I have never seen or heard of two real dwarfs in the same family, although it undoubtedly does occur. There are some cases where the thyroid is involved, and those are the cretinoid types. The cretinoid is a very definite type of dwarf, but I believe there are some in whom the thyroid shows no evidence of any disturbance.

Note. All the cases reported in this article were illustrated by lantern slides, but it has been found impracticable to reproduce them here.

Passing for a moment into the domain of Pathological Anatomy, *we find the same elements in morbid growths that we have met with in normal structures. The pus-corpuscle and the white blood-corpuscle can only be distinguished by tracing them to their origin. A frequent form of so-called malignant disease proves to be only a collection of altered epithelium-cells. Even cancer itself has no specific anatomical element, and the diagnosis of a cancerous tumor by the microscope, though tolerably sure under the eye of an expert, is based upon accidental, and not essential points—the crowding together of the elements, the size of the cell-nuclei, and similar variable characters.* From Border Lines of Knowledge in Some Provinces of Medical Science by Oliver Wendell Holmes.

SOME OF THE PITFALLS IN THE ROENTGENOGRAPHIC DIAGNOSIS OF COLONIC LESIONS WITH SUGGESTIONS AS TO THE PROPER METHOD OF OVERCOMING THEM*

BY W. H. STEWART, M.D.

NEW YORK CITY

THE universal conclusion that abnormalities of the colon can be easily recognized by the roentgen ray and that they do not require the attention given to the upper portion of the gastrointestinal tract, has proven erroneous. The usual roentgenograms before and after defecation following the filling of the colon with an opaque medium are not sufficient in many cases to reveal the lesion.

The common errors which one meets

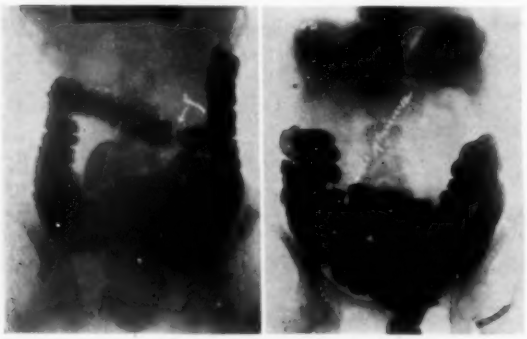

FIG. 1*a*. Defect in the transverse colon due to spasm. *b*. Defect in transverse colon due to Ca. Both cases proved at operation. The cause of the spasm seen in *a* was a chronic appendicitis.

in the roentgen diagnosis of colonic pathology are largely due to:

1. Neglecting to make a preliminary examination before the colon is filled with barium enema.

2. The difficulty in differentiating spasm from true pathology (Fig. 1).

3. The overshadowing of a lesion between haustral contractions by a distended colon (Fig. 2).

4. Filling defects caused by intestinal contents (Fig. 4).

5. The variance in the findings at different stages of filling (Figs. 4 and 5).

6. Overlooking the pathology on account of the extreme mobility of the lesion (Fig. 6).

7. Overshadowing by the barium enema of a lesion within the lumen of the colon which has produced no deformity.

It is with the hope of overcoming these errors that the writer ventures to suggest certain improvements in technique.

Each case must receive individual attention, the roentgenologist being familiar with the history and clinical findings before the roentgen examination is made. The patient must first be thoroughly prepared, usually by administration of mild laxatives, such as compound licorice powder,

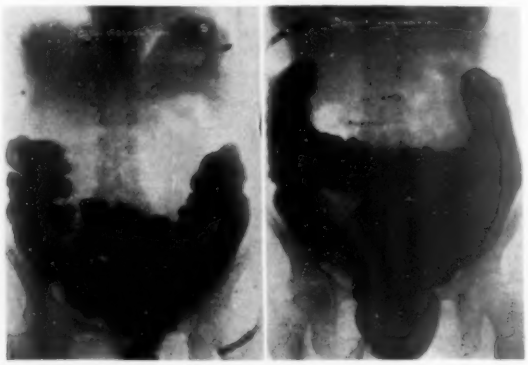

FIG. 2*a*. Defect in transverse colon due to Ca. seen in film taken after defecating part of the clysma. *b*. Colon of same case after distention with barium clysma. Note how the distended haustral folds overshadow the lesion.

given when possible the second and third nights before the examination. No cathartic, however, should be administered on the night before, as artificially stimulated peristalsis and spasm is to be avoided. On the day before, the diet should be restricted to soft, easily digested food having little intestinal residue. On the morning of the examination a colon irrigation of clear warm water is given, and repeated, if necessary, until the return flow is clear. Soap enemas should not be used. Dr. Hayes of New York has called our attention to the irritating properties of these solutions; they are likely to occasion resistance and spasm and to interfere with the use of the diagnostic enema.

Care should be taken that the tempera-

* Read at the Twenty-fourth Annual Meeting of THE AMERICAN ROENTGEN RAY SOCIETY, Chicago, Ill., Sept. 18–21, 1923.

ture of the examining room be at least 70°F. Chilled skin surface is not favorable to comfort, peace of mind, and perfect relaxation—all essentials.

When the patient arrives he is placed directly on the roentgenographic table

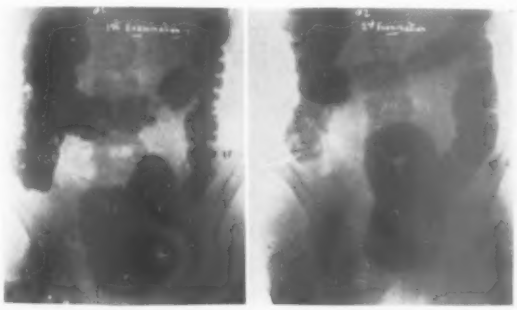

FIG. 3*a*. Persistent defect in outline of cecum. *b*. Same defect at second examination made four days later. Deformity believed to be due to retained intestinal contents, as a normal empty cecum was found at operation.

and a preliminary roentgenogram of his entire abdomen is made. This will avoid the error of overlooking any possible lesion which might be overshadowed by the barium enema such as nephrolithiasis or fecaliths. He is then transferred to

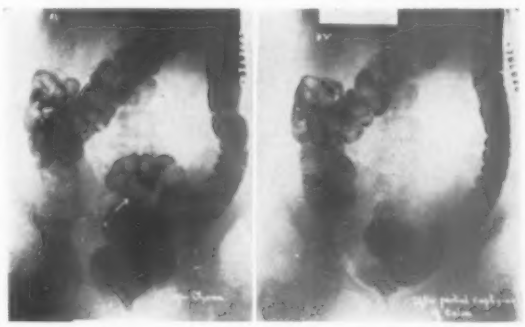

FIG. 5*a*. Colon after barium clysma; full distention brings out the defect indicating the lesion. *b*. In the partial collapse of the large intestine following partial defecation the evidence of the pathology disappears; the reverse of the case shown in Figure 4.

the horizontal roentgenoscope and the method of the proposed examination explained so that he will recognize what is about to take place. It is absolutely necessary to gain the patient's confidence, because his non-resistance will greatly aid in the procedure.

After thoroughly lubricating the anus, with the patient lying on the left side, a rectal tube, also lubricated and having a large opening at the end, is gently inserted into the rectum for 3 or 4 inches. Care should be taken to avoid any sensitive

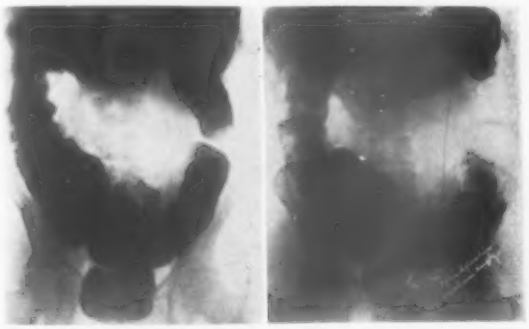

FIG. 4*a*. Colon after barium clysma. Note apparent normal ampulla. *b*. Same case after partially defecating the clysma. Note defect in ampulla indicating Ca.

hemorrhoids. The introduction of the tube should not be done blindly, but after deliberate exposure of the anus by separating the buttocks under sufficient illumination. I know of no one thing that will destroy the confidence of a patient more than to have a nurse or doctor poking

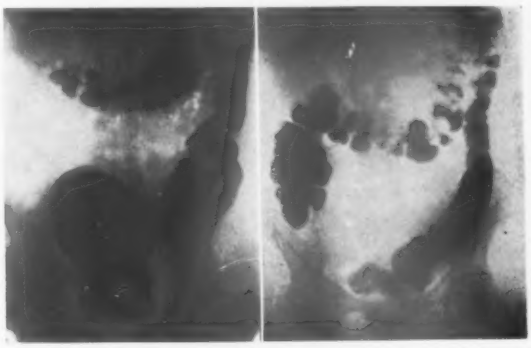

FIG. 6*a*. Note defect in colon outline at about the level of left crest; this defect indicates a carcinoma. *b*. After defecation. The patient's effort at defecating the clysma empties the colon distal to the lesion. Note that the defect seen at the pelvic brim is now well in the pelvis indicating free motility. The case on this account is favorable for surgical relief.

around blindly with a rectal tube before the anus is reached. After the tube has been properly passed, the patient is requested to turn gently on his back, the tube being supported while the movement is made. Before the rectal tube is inserted

it has been connected with the rubber tubing, generous in length, extending from an ordinary irrigating can which contains the enema. The latter consists of 4 oz. of barium suspended in 500 c.c. of mucilage of acacia mixed with 500 c.c. of hot water.

Before proceeding, two precautions are necessary:

(1) That all the air has been expelled from the entire length of the tube before it is inserted into the rectum. To force air into the rectum ahead of the enema is most distressing to the patient and may defeat the entire procedure.

(2) That the irrigating can is not suspended more than 9 in. above the level of the anterior abdominal wall. The usual custom of elevating the irrigating can to such a height that the opaque medium rushes into the colon, is to be avoided; spasm and distress are the results.

The nurse is then stationed in such a position that she does not interfere with the roentgenoscopist, but where she still has control over the clamp on the tube. The screen is placed on the abdomen and the room darkened. After waiting a full five minutes for the eyes to become accommodated, the examiner notes on the screen whether the tube has been properly placed in the rectum, and the nurse assures herself that there are no kinks in the tube and that there is no obstructive outside pressure. At the signal from the observer the solution is allowed to flow gently until the ampulla is filled, observations being made as this occurs. If the case is one suspected of a lesion in the lower bowel and the observer is not convinced of a normal outline, the can may be lowered and a portion of the enema allowed to flow back; raising the can to the original height the observer may again witness the filling. At this point it is well to assure the patient that should he have excessive pain or desire for stool the injection will be stopped until the spasm is relieved. Usually there is some slight delay after the ampulla has filled, but suddenly, after the sigmoid has unfolded, the opaque mixture shoots up the descending colon; in fact if the operator does not watch closely, he will lose the ascent and may miss the lesion, especially if it is not obstructive. The barium enema is now allowed to flow in gently under the constant eye of the observer until it reaches the cecum; which usually takes about five minutes. The moment the cecum is filled the injection should be stopped. The reason we so often see patency of the ileocecal valve is largely due to an excessive amount of opaque solution injected into the colon. During this filling, if there is an unusual delay at any portion of the large intestine, one should wait a moment to be sure it is not due to spasm; at the same time the intestines can be gently manipulated under the screen by the gloved hand or by a wooden spoon, and fixed points or deformities detected. A mark is made on the skin locating the lesion which has been observed. The light is then turned on and the tube removed. The patient is now transferred to the roentgenographic table and a series of roentgenograms quickly made, especially covering the marked area. One should not depend on one film for record but should verify his roentgenoscopic findings by a series of films which should correspond in number to those usually made of the stomach. If the patient is retaining the enema without distress a stereoscopic pair of films of the entire colon should be made. The patient is then instructed to expel a moderate amount of the enema after which another series of films is taken. He is then allowed to empty the colon as completely as possible, when further films are taken, followed by a final roentgenoscopic examination.

In many instances it is advisable to confirm the findings made with the enema by observations following the barium meal.

The use of a combined roentgenoscopic and roentgenographic table is a great advantage in the examination of these cases. The disturbance to the patient in the transfer from one table to another may defeat the procedure, especially where it is necessary to have the enema retained for any length of time.

In cases in which the lesion is within the lumen of the colon without producing deformity, the barium enema overshadows the growth so that it cannot be recognized by the ordinary methods of examination. Lesions in such cases can be detected by a

method suggested by Dr. A. W. Fischer of Frankfurt, Germany. He first gives the patient a moderate amount of barium enema, followed by further colonic distention with air, both of which are administered under roentgenoscopic control. If the suspected growth involves the transverse or pelvic colon, the patient is allowed to expel a portion of the enema before the air is injected. With this method it has been found that the most satisfactory information can be obtained in the lateral positions.

When all other methods fail to give the desired information we may finally resort to pneumoperitoneum.

THE ROENTGENOLOGICAL DIAGNOSIS OF CRANIOPHARYNGEAL POUCH TUMORS*

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A very common situation for intracranial tumors is the region in and about the pituitary fossa. The pure pituitary tumors are usually adenomatous, sometimes cystic, more often solid, and lie within the pituitary fossa, largely distending it. The roentgen appearances brought about by this condition are well known, for the fossa may be hollowed out to an astonishing size, and indeed its posterior clinoid process may become completely absorbed.

Other tumors in this situation may produce the same local syndrome of optic atrophy and changes in the fields of vision. The sella may or may not be deformed and the preoperative pathological diagnosis may be very difficult. However, the nature of one of these lesions may be betrayed by the appearance of calcareous shadows. The object of this paper is largely a discussion of this particular point.

These tumors, which so often cast shadows due to calcification, have been much written about and are commonly known as "craniopharyngeal pouch tumors" or "suprasellar cysts."[1,2,3]

INCIDENCE

The numerical relation of these tumors to other tumors in the neighborhood may be roughly estimated from the following table, representing 253 verified tumors observed in this clinic in this particular anatomical region.

	Number of cases	Percentage of 253 verified tumors	Percentage of all verified tumors in this clinic (930 cases)
Pituitary adenomas	180	71.1	19.3
Pharyngeal pouch tumors	46	18.2	4.9
Meningiomas	12	4.7	1.3
Gliomas (optic chiasm)	8	3.1	.8
Teratomas	5	2.0	.5
Cholesteatomas	2	0.9	.2

It must be realized that these figures are by no means exact, for the primary tumors of the optic chiasm have only recently been described by Martin and Cushing.[4] The meningiomas also are in all probability more numerous than given in this table. Although pituitary adenomas unquestionably are the most common lesion, they have an undue prominence in the table, for the reason that only in the last seven or eight years have transfrontal exploratory operations become common in this clinic, and so histological verification of the craniopharyngeal pouch tumors made possible. Also there is a group of "pituitary tumors, unverified," in which there are several unquestioned craniopharyngeal pouch tumors showing the characteristic calcification, but the patients have not been operated on either because the lesion was in a quiescent stage or because they already had complete blindness.

* Read at the Fifth Annual Meeting of the Eastern Section of THE AMERICAN ROENTGEN RAY SOCIETY, Atlantic City, N. J., Jan. 24–26, 1924.

PATHOLOGY

The pathology of these tumors is well known. They arise from the pharyngeal pouch (Rathke's pouch) which forms the anterior lobe of the pituitary gland and, being congenital, are found most frequently in young people, the average age being twenty-two and two-tenths, the oldest fifty-seven and the youngest five.

These tumors vary in size from 2 to 8 cm. in diameter and consist of solid and cystic portions. Gross calcareous nodules are seen, especially in the smaller solid nodule, which microscopically is composed of masses and columns of epithe-

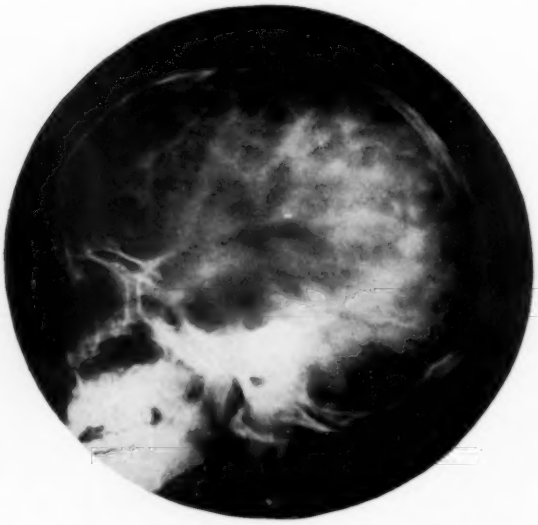

FIG. 1. Case 17235, illustrating marked deformity of the sella and extreme degree of convolutional atrophy due to increased intracranial pressure. Calcification faintly visible directly above sella.

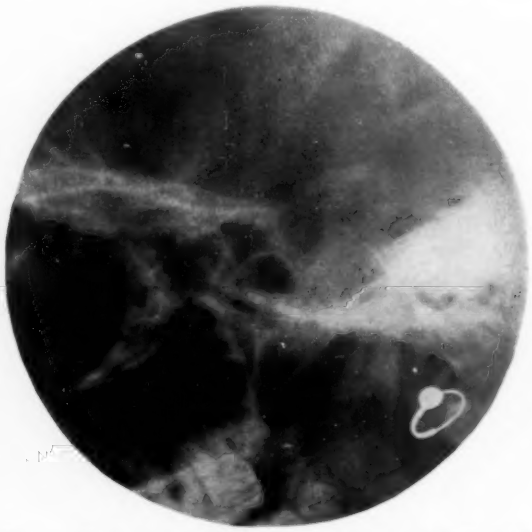

FIG. 2. Case 2990, showing a small, normal sella with dense calcification above the posterior clinoids.

FIG. 3. Case 1345, showing a moderately enlarged sella with dense calcification inside the pituitary fossa.

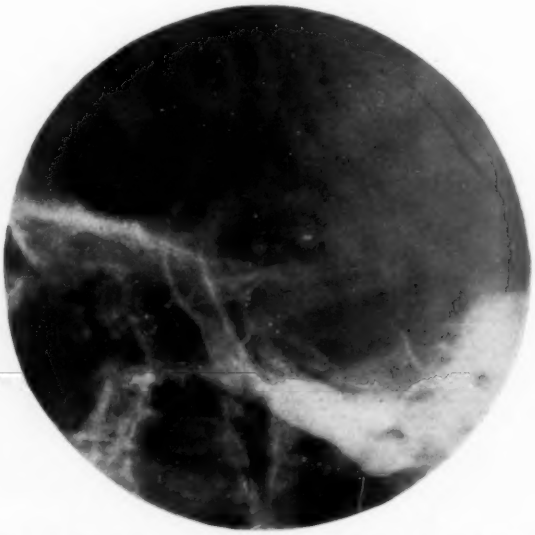

FIG. 4. Case 4345, showing a markedly enlarged sella with erosion of anterior and posterior clinoids, quite similar to that seen in pituitary adenoma. Calcification faintly visible above pituitary fossa.

lial cells, identical in structure with those of the buccal epithelium. The cells may or may not be keratinized; intercellular bridges and intracellular fibrillae are often seen, and pearl formation is common.

FIG. 5. Case 26941, also illustrating marked deformity of the pituitary fossa with thinning of the clinoids as in pituitary adenoma. Calcification too faint to be reproduced.

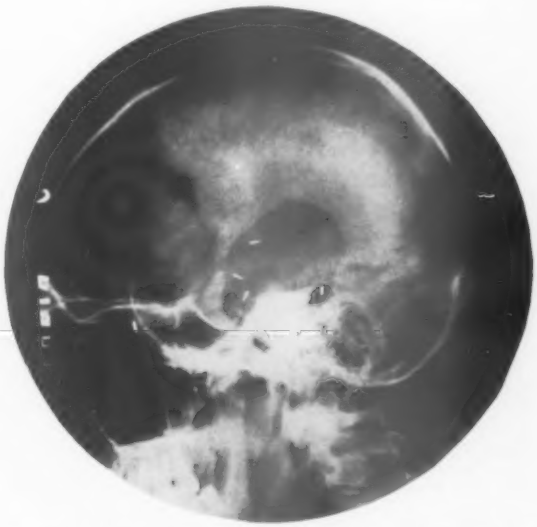

FIG. 6. Case 20316, showing a slightly deformed sella with faint spongy calcification directly above it. A typical case.

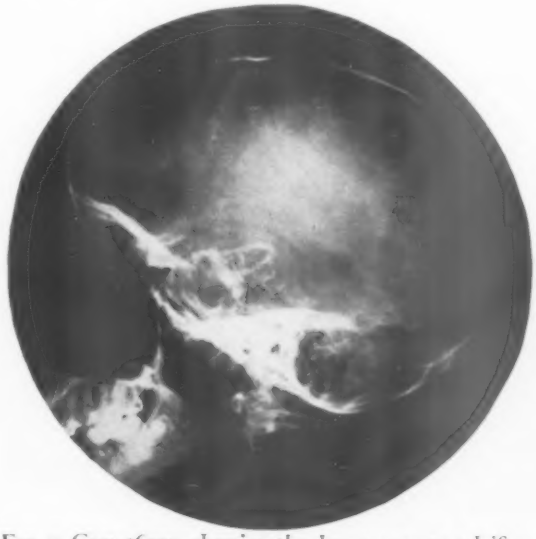

FIG. 7. Case 26993, showing the dense, spongy calcification above the pituitary fossa. The strand-like formations are unusual. Pituitary fossa considerably enlarged and deformed.

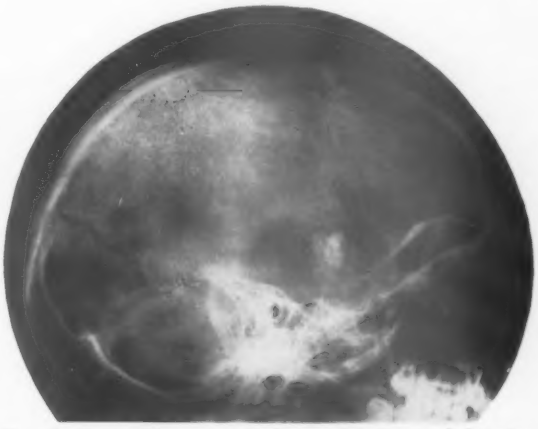

FIG. 8. Case 16629, a typical case. Moderate deformity of sella with a spongy, calcified mass directly above it.

There is a certain amount of connective tissue stroma, often showing mucoid degeneration. Calcium deposits are found within the epithelial cells. The cyst portion, which usually contains a characteristic golden syrupy fluid with glistening cholesterin crystals and epithelial debris, may be single or multilocular. Small calcareous nodules not larger than a pin-head may be scattered throughout the wall, which consists of a mass of fibrillae and is fairly tough and resistant.

Duffy[3] has described a cystic papillo-

matous tumor lined with columnar epithelium, which he believes arises from Rathke's cleft in the pituitary gland. In none of the tumors seen here could columnar epithelium be found.

SYMPTOMATOLOGY

Patients with craniopharyngeal pouch tumors, practically without exception, report because of increasing defect in vision. The main subjective and objective findings are conveniently grouped under two headings:

I. *Neighborhood*

1. Primary atrophy, resulting from direct pressure on the optic chiasm and nerves. The lateral portions usually escape for a time and so a bitemporal visual field defect is found.
2. Bitemporal headaches and a feeling of discomfort behind the eyes.
3. Positive roentgen-ray findings, discussed in detail later.

II. *Glandular*

The evidence of glandular disturbance in older patients is often negligible. In the young a fairly typical picture of dyspituitarism is usually seen, consisting essentially of non-development of the sexual organs, dwarfism, and a lowered metabolism. Mentally they are alert and even precocious.

The diagnosis is occasionally quite confusing. Bailey[5] has reported from this clinic 2 cases which gave the typical signs and symptoms of a cerebellar tumor. In one of these the correct diagnosis was made entirely on the presence of calcification above the sella.

FIG. 9. Case 27119, illustrates relative size of cyst (filled with air) and solid portion which is calcified.

FIG. 10. Case 24137, shows huge cyst occupying the frontal area and communicating with the anterior horn of the ventricle. Calcification small in amount and situated on a level with the clinoids.

ROENTGEN-RAY CHARACTERISTICS

In our study of 35 verified cases of craniopharyngeal pouch tumors, 71 per cent showed the characteristic calcification, which is delicate and spongy in appearance, irregular in formation and not outlining in any of our cases a section of the cyst wall, as in intracranial aneurysms or dermoids. This is due to the fact that the calcification is nodular in character, occurring chiefly in the solid part of the tumor. As shown on the films, it may vary in size from a few faint specks to a mass 8 cm. in diameter. In the majority of cases, the shadows are seen in the midline, either directly above the sella or over the anterior clinoids. In 2 cases only were they located within the fossa.

The outline of the sella was abnormal in 27 cases, or 76 per cent, this abnormality

usually consisting in enlargement of the fossa with irregularity and "depression" of the floor. (Dr. Cushing has suggested that this apparent depression of the floor with more or less obliteration of the sphenoid sinus may be due to a maldevelopment of the sphenoid bone, associated with these

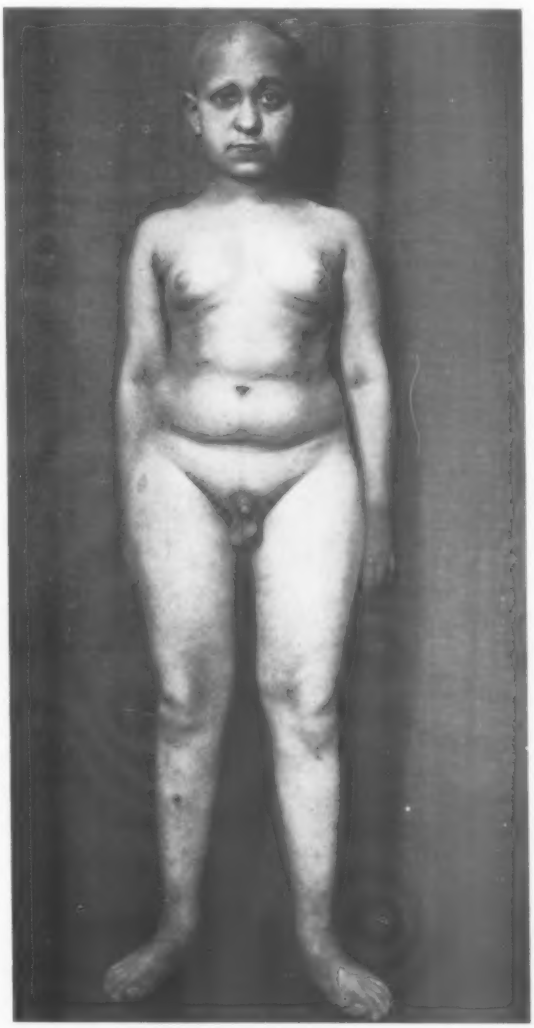

FIG. 11. Case 27119 (see Fig. 9). Photograph of patient aged sixteen showing adiposo-genital dystrophy (hypopituitarism).

congenital tumors.) There was destruction in 26 cases, frequently limited to the posterior clinoids, but varying in degree. Generalized pressure, as evidenced by the convolutional atrophy, was present in 17 cases, and extremely marked in 4. One case, not included, was reported as a suprasellar cyst but was found at operation, to be an adenoma, the apparent "calcification" being fragments of the clinoids lifted up by the expanding tumor.

ROENTGENOGRAPHIC TECHNIQUE

The technique varies but little from that which is standard in most laboratories. We use a fine focus radiator tube at 22 in. distance, with a 4½ to 5 in. gap and take all skulls stereoscopically on the Potter-Bucky diaphragm. In few instances A.P. or P.A. films are made, but in the majority of cases this is unnecessary. Double screens are used with super-speed films and particular attention is paid to immobilization. The films are exposed and developed so that the soft tissues are obliterated, giving the appearance of a moderately over-exposed film. This is necessary to get the detail of calcification above the sella, which is often lost in the shadow of the cranial vault on "lighter" films.

TREATMENT

Treatment offers very little for the glandular disturbance, and so narrows down to the saving of vision by removal of

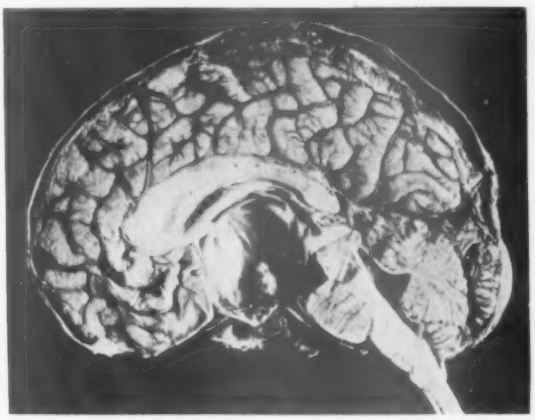

FIG. 12. Case 993, sagittal section of brain showing cyst formation just inferior to the third ventricle with papillary ingrowth containing calcium.

pressure on the optic chiasm and nerves. It is essential that if anything is to be done for these patients, operation must be performed before there is complete loss of vision.

There are two operative routes followed in this clinic for pituitary cases.

1. The transfrontal, in which a frontal bone-flap is turned back, the frontal lobe elevated and the sellar region thus exposed.

2. The transphenoidal, in which the floor of the pituitary fossa is removed from below, through the sphenoid sinus.

The route chosen depends not only upon the pathology, but also upon the architecture of the sella and the age of the patient. The route of choice in craniopharyngeal pouch tumors is the transfrontal. The establishment of the pre-operative diagnosis is important in deciding the route. In several of the cases seen here, the age of the patient and the architecture of the sella were such that a transphenoidal operation might have been performed if it had not been for the tell-tale calcification.

SUMMARY

The roentgen plates of 35 cases of verified suprasellar cysts have been studied. A positive, correct diagnosis could be made in 25 from the pathognomonic calcification. Five were frankly negative and 5 were doubtful.

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The authors wish to take this opportunity to thank Dr. Cushing for permission to study these cases.

METHODS OF IMPROVING THE EXTERNAL APPLICATION OF RADIUM FOR DEEP THERAPY

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RECENT developments of roentgen-ray apparatus and roentgen-ray technique have given this agent the chief place in external radiation in deep therapy. The radium pack, however, has a definite place of its own and should be used in certain cases, as has been pointed out by the writer in a previous article in this Journal.[1]

"Radium pack" is a commonly used term for an applicator containing a number of radium or emanation tubes spread over a large surface, which is placed at a distance from the skin, usually 4 to 10 cm. The pack has been used to a great extent in the United States at places where one gram or more of radium has been available. It has certain advantages over a roentgen-ray machine, viz.: it can be easily transported and used in any room; it can be applied without difficulty to any part of the body; there is no high tension electric current to consider and thus no danger of serious shocks and the absence of the production of ozone and oxides of nitrogen gases; there is no fluctuation in the radiation and thus no uncertainty in the given dose, which can be easily calculated with an error of less than 1 per cent. The physician can apply the pack in a few minutes and the nurse on duty can then look after the patient, as a glance at him now and then is all that is necessary. But, on the other hand, there are also some serious objections to the old-fashioned pack as it has been used during the past.

1. It takes a great distance and long time, with a reasonable amount of radium to get a depth dose comparable to the depth dose from filtered roentgen rays produced by 200 kv.

2. The arrangement for screening undesirable rays is very unsatisfactory and does not give enough protection. The gamma rays spread out in all directions from the tubes. All those which

[1] Stenstrom, K. W., and Gaylord, H. R. Comparative measurements between radium and *x*-rays concerning energy absorbed at depth. Am. J. Roentgenol., & Rad. Ther., Jan., 1923, x, 56–62.

do not hit the field on the skin (say 10 × 10 cm.) directly under the pack are of no value in the treatment; on the contrary they often do much harm and ought to be absorbed before they reach the skin. They are, however, very penetrating and it takes about 1 cm. of lead to reduce the intensity to one-half. The pack should, therefore, be surrounded by very heavy lead walls, a condition which cannot be fulfilled with the old-fashioned pack because it rests, as a rule, upon the patient, and, therefore, must not weigh more than a few pounds. Even then, it troubles the patient considerably, as it has to be kept in the same position for several hours. The lead walls, therefore, are usually not more than 2 to 3 mm. thick and consequently the patient gets considerable radiation through these walls outside of the desired field. It also is quite dangerous to handle a large quantity of radium with so little protection. The physician who has to apply the pack and the nurse who takes care of the patient are necessarily exposed to a certain extent. I think it is a common experience that nurses who attend to the old-fashioned pack complain of feeling unusually tired all the time. Their blood-counts often show a decrease in the number of leucocytes. Though the drop is usually nothing serious, it is distinct, and evidently is due to too much exposure, as the blood picture quickly returns to normal as soon as the nurse stays away from the pack.

3. The distribution of the gamma-rays inside the body is poor. Each individual radium tube or container is, with full strength, radiating the whole field, and the rays thus spread out into a cone or pyramid of wide angle, so that the tumor gets only a part of the energy absorbed by the whole body. This is a very serious objection to the old-fashioned pack, as the poisoning of the system from broken-down cells, the effect on the blood, etc., is proportional to the total amount of radiation absorbed, while the good effect seems to depend only upon the amount absorbed by the tumor itself and the immediately surrounding tissue. This objection is still more pronounced if we consider that the total skin area outside the field receives more radiation than the field itself.

All these objections against the old-fashioned pack are directed entirely against the poor and primitive way in which the radium is applied. I will now discuss in a general way the principles we must follow in order to overcome these objections, and will then describe the pack we have constructed and are now using at the State Institute.

It is evident from the above discussion that the applicator must be made very heavy. It is necessary, therefore, to attach it to a stand of some sort. It must, of course, be attached in such a way that it can be easily applied in any direction to any part of the body. Its weight does not need to be further considered if such a stand be used. The next question is how to distribute the individual radium containers and how to direct the rays.

Suppose at first, that the whole amount of radium for disposal is concentrated into one small container, and that a tumor 5 cm. under the skin surface, and occupying a volume of 3 × 2 × 2 cm., is to be radiated. Wherever the container is placed, it ought to be screened so that the ray beam is just a little wider than is necessary to take in the whole tumor, or at times a part of it. If only one field is used the container should, of course, be put directly over the tumor (Fig. 1).

The farther away the pack, the greater is the amount of energy absorbed by the tumor per erythema skin dose. Suppose that E is this tumor-dose and that it is given in the time, T, when the tube is 2 cm. away from the skin. The maximum tumor-dose and the required time when the tube is farther away, can then be calculated approximately with help of the inverse square distance law. For example, if the tube is at a very great distance (1 meter or more) the dose will be very close to $\frac{(5+2)^2}{2^2} \times E$, or 12.25 E, while the time will be intolerably long (at 1 m. distance $\frac{100^2}{2^2} \times T = 2500\,T$). At 3 cm. distance the approximate dose will be 12.25 E ×

$\frac{3^2}{(5+3)^2}$ or 1.7 E, and the time $\frac{3^2}{2^2}$ T or 2.3 T. The general formula for the approximate dose at the distance d cm. is $\frac{(5+2)^2}{2^2}$ E $\times$ $\frac{d^2}{(5+d^2)}$ and for the time: $\frac{d^2}{2^2} \times$ T.

The figures in Columns 2 and 3 of Table I have been calculated in this way.

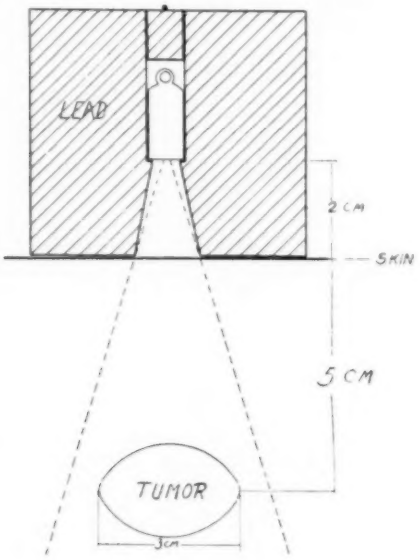

FIG. 1.

TABLE I

Distance from Skin, Cm.	Tumor Dose	Time per Erythema Dose	Time per Dose E. of Tumor
2	1.0 E	1.0 T	1.0 T
3	1.7 E	2.3 T	1.3 T
4	2.4 E	4.0 T	1.7 T
5	3.1 E	6.3 T	2.0 T
6	3.6 E	9.0 T	2.5 T
7	4.2 E	12.3 T	2.9 T
8	4.6 E	16.0 T	3.5 T
10	5.4 E	25.0 T	4.6 T
20	7.8 E	100.0 T	12.8 T

If the container is at a distance of 5 cm. from the skin, then the tumor will absorb 3.1 E. in the time 6.3 T (see table). However, this dose can be given in 3.6 T, or almost half the time with four symmetrical fields and the container at a distance of 2 cm. from the skin, in one following the other of the corners of a square with 5 cm. sides. Four equally strong radium containers can, of course, be used instead in this case if the screening is arranged with care, as is indicated in Figure 2. There are two conditions which we must consider, viz., the field under one tube will receive some rays from the other three tubes. That is the reason why 3.6 T was chosen above instead of 4 T, allowing for 10 per cent of the erythema skin dose through the

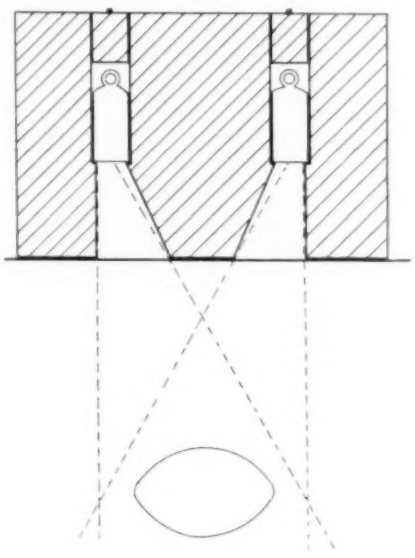

FIG. 2.

lead screen. A subcutaneous burn may be produced if the beams from the four containers cross too near the skin. That is why so great a distance between the tubes should be used.

It is evident that a greater number of containers can be used in a similar way, and that the screening can be so arranged that the fields on the skin from the different containers do not overlap as they do in the old-fashioned pack, and that there will be no danger of getting a subcutaneous burn. For the sake of convenience, the lead screening carrying the containers should be made in one piece, with each hole of a particular shape, directing the ray beam from each container. Such a lead screen will work as a mechanical lens, and will be referred to, therefore, as the "condenser."

If an unvaried amount of radium salt is to be used at all times, so that the num-

ber of the containers and their size and strength are fixed once for all, then it is fairly easy to construct a suitable condenser, but the problem of constructing a condenser which can be used for a varying number of containers of different strengths is more complicated, although more important. This latter problem we will now consider. It is evident that a homogeneous distribution of the rays can only be arrived at if the position of the condenser be changed during the exposure. The simplest way to meet this condition is to make the condenser circular and let it rotate around its axis. The applicators must be distributed along one or more circles of the upper surface of the condenser disc. The distribution of the radiation is dependent upon the diameter and thickness of the condenser, the number of holes in it and the shape of these holes.

It is a general rule that the intensity ought to be as even as possible over the whole field on the skin, in order that the maximum amount of radiation may pass through it. The holes, therefore, should be triangular in shape, the apex of the triangle pointed toward the center of the condenser (A in Fig. 3). If all the holes were alike and of simple triangular shape, all the beams would start to cross one another at one point, producing concentration of radiation in this area. To avoid this, it is necessary to bend off the apices of the triangles to one side, or to split them into two parts, with an edge of lead between (B and C in Fig. 3). A heavy ring-shaped concentration would be produced if all the triangles were bent off in this manner. By combining these two types of holes in a suitable way, the heaviest concentration will take a more cylindrical shape. It would be very difficult to calculate the exact shape of the holes for a certain desired distribution, and it undoubtedly is better to find the final shape and combination of the holes experimentally after an approximate calculation. The photographic method can be conveniently used for determining the distribution of the radiation. This can be changed, if desired, by slight changes in the shape or combination of the holes. Films should be exposed both in the direction of and at right angles to the rays. Figures 4 and 5 illustrate the distribution in a plane through the axis of the condenser (films parallel to rays) when triangular holes only are used. Figure 4 represents fairly large holes. It illustrates how easy it is to get greater intensity at a point inside the body than on the skin and how a subcutaneous burn may be produced from rays which do not leave any mark on the skin. This fact should be a warning against the use of cross-fire without exact calculations.

In accordance with the principles given above, we have recently built a pack at the State Institute which now is in daily use. It consists of three main parts.

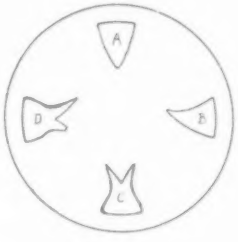

Fig. 3.

1. A cylindrical box of 14 cm. outer diameter and 9 cm. height made of a brass sheet 1 mm. in thickness covered with 1 mm. of aluminum (A in Figs. 6 and 7). The inner wall is lined with lead 1.5 cm. thick. This box hangs in two steel studs which are attached opposite each other to the outside of the wall.

2. The rotating condenser is shown in Figure 6-B (top view) and Figure 7-B (bottom view). The important part of it is the 3 cm. high disc (lead) with its carefully carved holes. On top of this disc is a sheet of brass carrying the emanation containers. Eleven such containers are shown in position in the figure. In the center of the disc is mounted a steel shaft which transmits the rotation. The condenser fits snugly in the box and is balanced on a pivot bearing, so that friction against the bottom is avoided.

3. There is a cover (C in Figs. 6 and 7) which consists of a brass disc 4 mm. thick and 14 cm. in diameter, which can be fastened to the box with bolts and wing

nuts. To this disc is attached a lead disc 2.5 cm. thick, which fits snugly in the box. Through the center is a shaft for transmission of rotation from a motor to the

An old roentgen-ray tube-stand has been rearranged to make an ideal carrier for this pack (Fig. 8). The former tube-holder has been replaced by a heavy steel

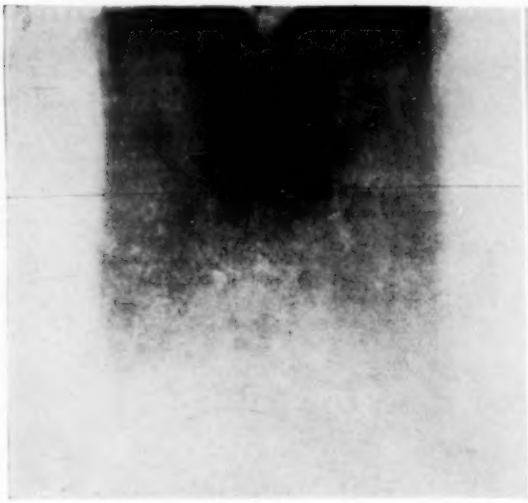

FIG. 4.

FIG. 5.

condenser. The lower lead surface is covered with a sheet of brass to which is attached two sheets of fiber.

bar bent into a semicircle. The bolts in the box fit into slots at the ends of this, so that the pack can be tilted to any angle and

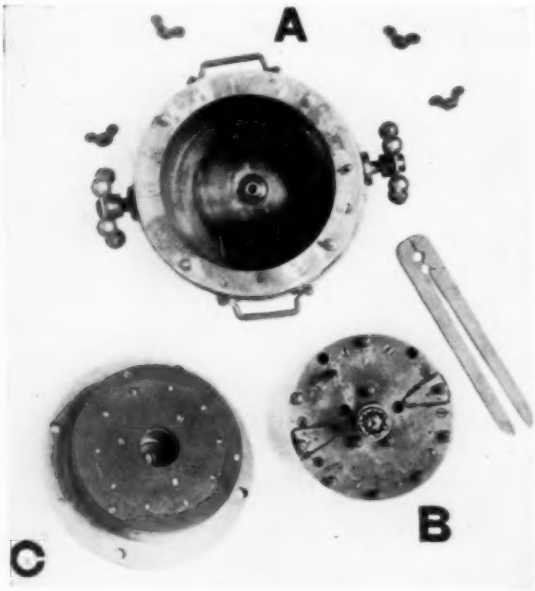

FIG. .6

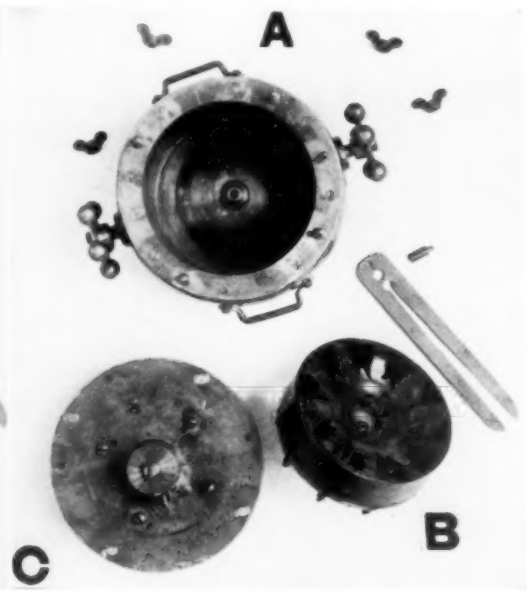

FIG. 7.

The construction of a rotating pack was proposed by Dr. H. R. Gaylord. We are also obliged to E. Pohl for certain advice in connection with the rotation scheme.

fixed with hand nuts. The stand is constructed for all other desired kinds of movements, and therefore it is easy to apply the pack. The rotation is taken

care of by an electric motor mounted on the same steel tube that carries the pack, a brass rod with universal joints and the shafts leading through the cover and down to the condenser. Other rotation mechanisms may be substituted, for example, a clockwork mounted on the cover.

It is of great importance that the condenser be kept rotating continuously

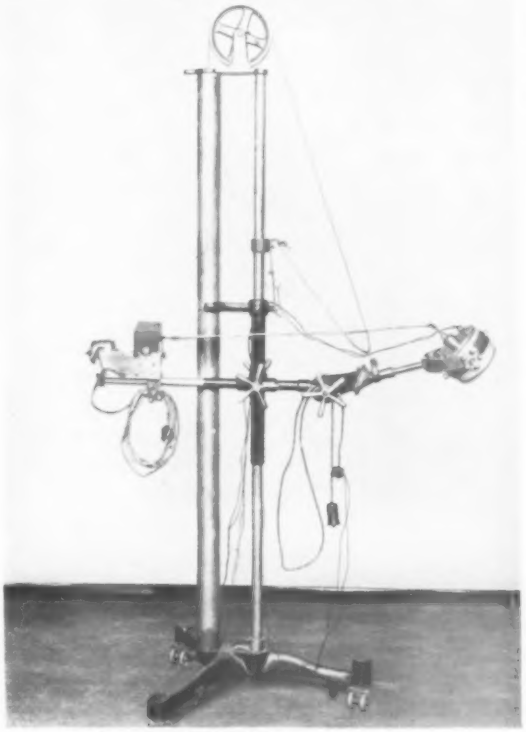

Fig. 8.

during the treatment, as a burn may be produced if it is standing still for more than one-tenth of the time. A signal system, therefore, has been combined with the pack which immediately reports if the condenser stops. It is constructed in the following manner: There are placed in the lower fiber sheet attached to the cover some brass buttons, which are connected with a copper wire between the fiber sheets. A brass spring attached to the condenser slides over these buttons, closing a light circuit for a second each time it passes over one of them, thus making signal lamps flash regularly as long as the condenser rotates.

The most interesting parts of this pack are, of course, the shape and the distribution of the holes which determine the distribution of the radiation. Figure 9, which is a bottom view of the condenser, demonstrates these graphically. It shows that there are fifteen holes of three different types arranged in two rings. Two holes in the outer ring are of Type A in Figure 3. At the under surface of the condenser these triangles have a height of 2.6 cm. and a base of 2.2 cm. The holes grow narrower toward the upper surface of the condenser where they are circular, and of 6 mm. diameter. Eight holes of the outer ring are of Type D in Figure 3 and of about the same size as the two triangular ones, with a

Fig. 9.

minimum height of 1.9 cm. The five holes in the inner ring are conical with 4 mm. diameter at the top and 6 mm. diameter at the bottom, and the central line is directed against a point about 8 cm. under the pack.

These dimensions were obtained through calculation in the following way: (1) The upper diameter of the hole should be approximately equal to the diameter of the bulb (3 to 5 mm.). (2) The width of the hole has been determined so that no overlapping takes place until 1 cm. under the condenser. Ten bulbs have to cover $2\pi \times 5$ cm. at the periphery of the cylinder 1 cm. under the condenser, each one, therefore,

3.14 cm. The arc at the bottom of the hole in the condenser, therefore, should be $(3.14. - .16) \times \frac{3}{4}$ cm. = 2.2 cm. (Fig. 10). (3) The rays through the triangular holes should start to meet 3 cm. under the condenser and the height, X, was calculated

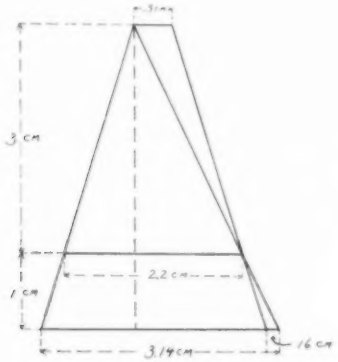

FIG. 10.

from the equation $x/5 = \frac{3}{6}$ (Fig. 11); therefore X = 2.5 cm. The rays through the holes of Type D should start to meet in the axis 5 cm. under the condenser and the height Y was calculated from the equation $Y/5 = \frac{3}{8}$; therefore Y = 1.9 cm.

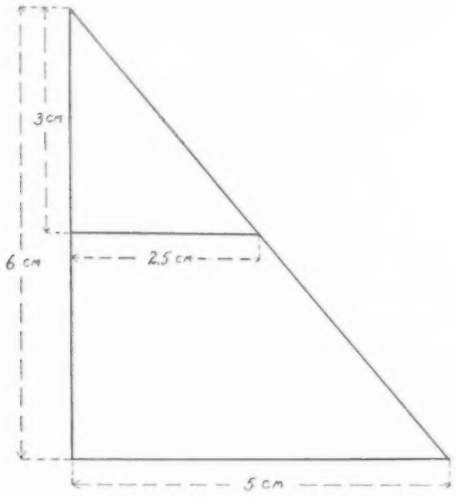

FIG. 11.

It is evident that the emanation should be well concentrated in small glass containers. Ordinary tubes could be used if they were placed vertically above the holes, but bulbs are preferable, as they allow better distribution of the radiation and make easier the concentration of the emanation. We can easily concentrate two days' output from our 2 gm. of radium (about 550 mc.) into one bulb of 3 to 5 mm. diameter. The brass containers used for these bulbs are cylinders of 5 mm. inner diameter with 1 mm. thick wall and bottom, and with covers which screw on. Only fifteen bulbs can be used in the pack, and therefore, we concentrate the emanation from a number of old bulbs into one as soon as we accumulate too many. This is done about once a week

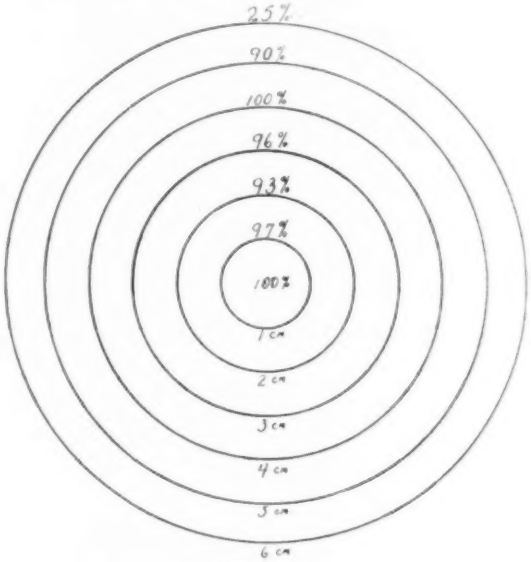

FIG. 12.

in a simple apparatus which has been described before in this Journal.[1]

The containers fit snugly into holes in the brass disc of the condenser, and each one is kept in position by a little peg pressed against it with a spring. The rays are filtered through 2 mm. of brass (1 mm. at the bottom of the container and 1 mm. at the bottom of the box) and 1 mm. aluminum (at the bottom of the box).

A very good distribution of the radiation is obtained with this pack if 16 per cent of the emanation is put on top of the conical holes, the same amount over the triangular holes and 68 per cent over the other holes. The distribution has been studied with the photographic method and the intensity at different points has been determined in such a way that the

[1] STENSTROM, K. W. A new device for retubing radium emanation. AM. J. ROENTGENOL., 1923, x, 311.

time of exposure was varied so that the same blackness, measured with a photometer, was produced at all of these points. If the greatest intensity directly under the pack is called 100, then the distribution at the surface is that of Figure 12. The field is sharply outlined. While the intensity varies between 90 and 100 per cent inside the field, it drops down to 25 per cent in less than 1 cm. outside the edge, and to about 10 per cent in another centimeter.

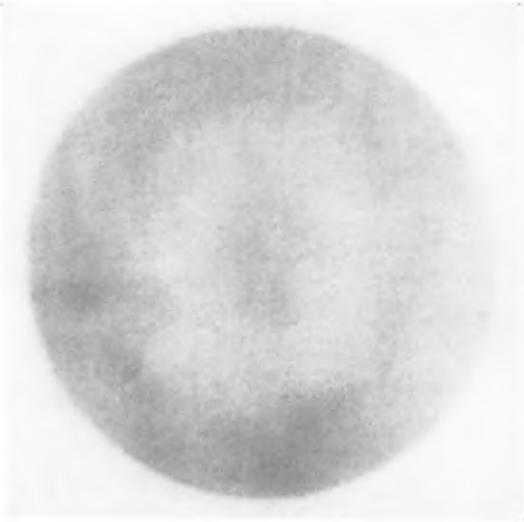

FIG. 13.

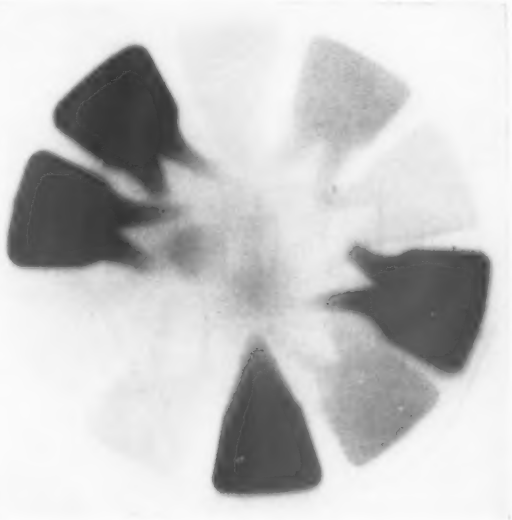

FIG. 14.

Figure 13 shows a film taken while the condenser was rotating, and Figure 14 was taken with the condenser standing still. Both films were placed immediately under the pack on top of a 10 cm. thick cake of wax. The same distribution of emanation was used and the same time of exposure.

Figure 15 shows how a film gets blackened if it is exposed in the center of the field at right angles to the bottom of the pack between two cakes of wax, while Figure 16 gives the distribution of the radiation at depth in percentage of the surface intensity. Figures 17 and 18 are the corresponding exposures with the old-fashioned pack. In comparing these figures it is striking how nicely the rays are being kept inside a cylinder directly under the new pack, while they spread out sideways when using the old pack.

A cylindrical volume of about 5 cm. diameter stretching itself from about 3 cm. to 10 cm. under the bottom of the new pack is especially useful for radiation of tumors. Beneath 10 cm. the rays spread out fairly rapidly.

If another kind of distribution is desired (for example, more concentration at greater depth), another condenser must be used with smaller or larger holes for a concentration deeper down or higher up. If a tumor 2 to 3 cm. under the skin is to be treated, it would be preferable to use a

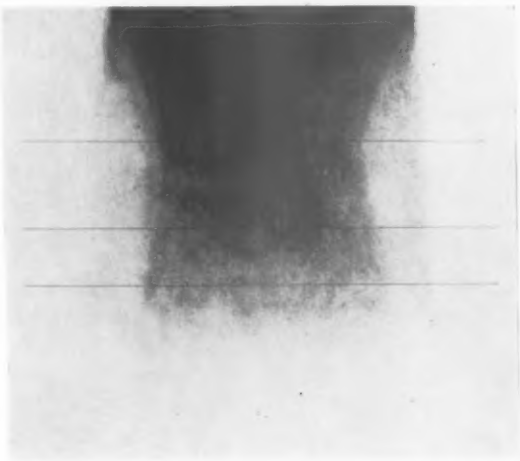

FIG. 15.

thinner condenser in order to reduce the time for the dose.

It is, of course, necessary to rearrange the containers when a new bulb goes into the pack or when an old one is taken out,

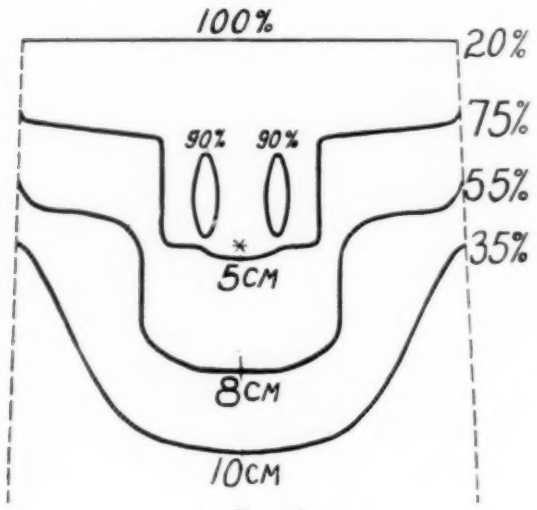

Fig. 16.

in order to get the right proportion of radiation from the different kinds of holes. This routine work is made easier if a simple sketch is made showing the holes numbered as they are in the condenser. The numbers

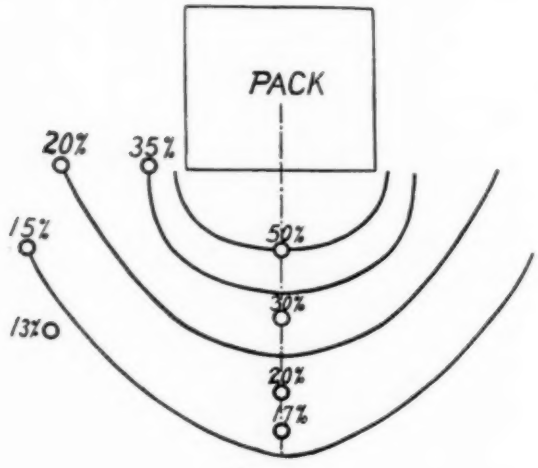

Fig. 18.

and strengths of the containers are then marked in the sketch where they should be placed. We are now using a rubber stamp with this sketch in order to save time. Figure 19 shows an acceptable arrangement. The outside printed figures are the numbers of the holes, the upper figure at each hole gives the number on the container and the lower figure, the amount in millicuries that it holds. If a constant amount of radium salt is used

Fig. 17.

in the pack, no such routine work has to be done.

The following table gives a comparison between the efficiency of the old pack and the new pack. The filter is for both 2 mm. of brass and 1 mm. of aluminum.

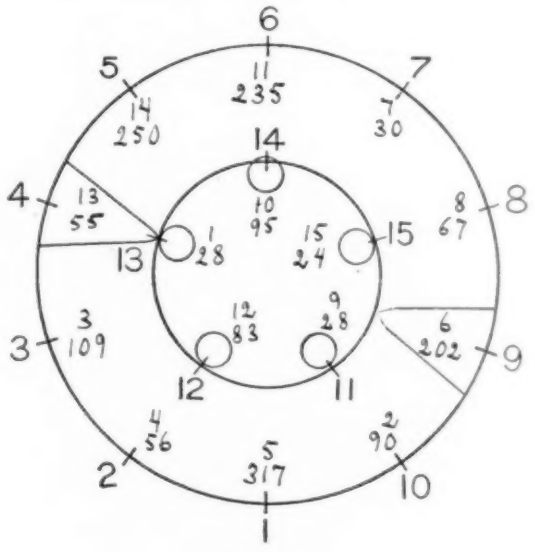

Fig. 19.

TABLE II

	Distance from Containers to Skin, Cm.	Depth Dose under Skin		Erythema Skin Dose, Gr.-hrs.	Field, Cm².
		5 Cm.	10 Cm.		
Old pack....	6.0	35%	17%	6	40
Old pack....	10.0	....	21%	15	
Old pack....	20.0	....	34%	60	
New pack...	3.3	75%	35%	17	80

The table shows that with approximately the same depth dose the number of gram-hours has been reduced from 60 for the old pack to 17 for the new one, which means that it now costs only about one-fourth of what it did before to get this depth dose of 35 per cent.

For about the same cost a depth dose of 35 per cent is now obtained instead of 21 per cent as before, an increase of more than 50 per cent. It is true that the area of the field is twice as large as it was before and that there was a possibility of using several fields with the old pack at 6 cm. distance. However, a considerable amount of radiation would reach the other fields when one field was radiated, even if the fields were relatively far apart. Therefore, the skin dose on each one would have to be reduced, and the depth dose reached with several fields is far from the depth dose reached with one field multiplied by the number of fields. Furthermore, the amount of radiation absorbed by the whole body would be very great, and four times the erythema dose with the pack at 6 cm. distance will cause a considerable change of the blood picture for most patients.

The greatest advantage of the new pack over the old one is that the amount of radiation absorbed inside a cylinder directly under it is about one-half the total amount absorbed by the body, while for the old pack this relation is of the order 1 to 10.

It is only at hospitals possessing large quantities of radium that packs of this construction can be of value. We keep our pack in use almost continuously day and night with about 1.6 curies emanation in it. It is too early yet to definitely determine the ultimate success in all cases with the new pack, but the results so far are much better than they were with the old pack. However, the time for the erythema skin dose is uncomfortably long (about ten hours) and probably better results could be obtained if 5 to 10 gm. of radium were used.

In the beginning of this article it was pointed out that the old radium pack had certain advantages, and certain disadvantages, as compared to the roentgen-ray tube. The new pack has all the advantages and at the same time is free from most of the disadvantages. It cannot, of course, compete with the roentgen-ray tube in economy, and an enormous quantity of radium is needed in order to produce the same effect in the same time. However, the peculiar distribution of radiation makes this pack more suitable than the roentgen-ray tube in many cases. For instance, a heavy dose can be put into the lower jaw and the tongue from beneath the chin. It will give a good distribution of radiation in the larynx. For certain breast tumors, it is favorable because sensitive surrounding tissues will be saved from heavy radiation. For the same reason metastasis in the axilla can be well attacked with it. The prostate and the vulva also can be radiated with it in a very desirable way.

Radiotherapy is rapidly gaining ground. However, it still is often severely criticized and declared a failure. It is a failure where it is misused, but the many wonderful results which have been obtained prove that rightly used it is a success. Not until we know when and how it ought to be used in order to get good results is the success ours. Many failures are due to the fact that patients are treated with radiation when it is not indicated. A still greater number of failures are dependent upon the fact that radiation is applied in the wrong way. Many patients have been cured or improved with the correct distribution of radiation after unsuccessful treatments with the improper dose. With improved applicators new fields for radiation open up and success may be obtained where it was before impossible to get results. Poor applicators used for radiation are worse than dull knives used for operations.

SUMMARY

The old-fashioned radium pack has certain advantages, but also serious disadvantages as compared to the roentgen-ray tube. Theoretical discussions show that some of these disadvantages are not inherent in radium, but can be eliminated through carefully constructed applicators. The fundamental principles underlying the construction of such applicators have been discussed here.

In accordance with these principles, a new radium emanation pack has been constructed,[1] and has here been described. The illustrations show how it is constructed and how the radiation is distributed, while Table II gives a comparison between it and the old-fashioned pack in regard to some important qualities. The most important advantage it has over the old pack is that the total amount of radiation absorbed by the body is only about twice the amount absorbed directly under the field, while with the old-fashioned pack the amount absorbed by the whole body is many times (say ten times) the amount absorbed directly under the field.

[1]A short note on this pack has been published in *Proc. of Soc. Exp. Biology & Med.*, 1922, xx, 65. It has been in use since July, 1922. This article was written in the beginning of 1923, but the publication unfortunately has been delayed. A pack with heavy lead screening has recently been described by Burnam and Ward in the Am. J. Roentgenol., 1923, x, 625. The principle of cross-firing from the individual tubes is not utilized in their pack nor is even distribution by continuous rotation obtained with it.

It was characteristic of Faraday's devotion to the enlargement of the bounds of human knowledge that on his discovery of magneto-electricity he abandoned the commercial work by which he had added to his small salary, in order to reserve all his energies for research. This financial loss was in part made up later by a pension of £300 a year from the British Government . . .

The discoveries made by Faraday were so numerous, and often demand so detailed a knowledge of chemistry and physics before they can be understood, that it is impossible to attempt to describe or even enumerate them here. Among the most important are the discovery of magneto-electric induction, of the law of electro-chemical decomposition, of the magnetization of light, and of diamagnetism. Round each of these are grouped numbers of derivative but still highly important additions to scientific knowledge, and together they form so vast an achievement as to lead his successor, Tyndall, to say, "Taking him for all and all, I think it will be conceded that Michael Faraday was the greatest experimental philosopher the world has ever seen; and I will add the opinion, that the progress of future research will tend, not to dim or to diminish, but to enhance and glorify the labours of this mighty investigator." From the biography of Michael Faraday in Harvard Classics, Vol. 30.

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Issued Monthly. Subscription $10.00 per year, $11.00 in Canada and $12.00 in foreign countries. Advertising rates submitted on application. Editorial office, 1621 Connecticut Ave., N.W., Washington, D. C. Office of publication, 67-69 East 59th Street, New York.

Information of interest to all readers will be found on page vii. Lists of officers of The American Roentgen Ray Society and The American Radium Society will be found on page preceding Editorial Section.

THE RESULTS OF THE EXPERIMENTAL STUDY OF CANCER

The experimental study of cancer has but a short history, yet its accomplishments in explaining some of the mysteries which surround this disease compare favorably with those obtained by the clinical study of human patients. But these phases of study, it must always be remembered, are complementary. Every step which has been made in the experimental study of the general biology of cancer has illuminated some old clinical observation, perhaps forgotten, or has suggested new points for clinical investigation. On the other hand, it must be borne in mind that the study of animal cancer, although it may have a certain general interest, is still primarily merely a convenient method of attack for the ultimate solution of the question in man, and is in itself, therefore, relatively unimportant. No sound vision of the whole problem will ever be reached unless the facts of human cancer are kept always in the foreground.

A complete review of the field of experimental cancer is manifestly impossible, but a few of the outstanding discoveries made by means of animals may be of interest.

One of the first things noticed was the fact that animal tumors, after they had been inoculated into a healthy host, would disappear spontaneously. This was seized upon as pointing toward the possibility of a cure of human cancer, forgetting that in a grafted tumor the host is merely a culture-tube and the tumor not perfectly adapted to the soil in which it grows. Unfortunately the human tumor with one exception, chorionepithelioma, is perfectly adapted to its soil.

These spontaneous disappearances, while they have not led to cure, have called renewed attention to those curious spontaneous cessations of growth which we see in human beings. Sometimes these cessations are long enough to warrant the belief that a true cure is being observed, but usually, if the cases are followed for a number of years, the tumor regains its old vivacity of growth and the patient dies. So, in general, when a human tumor disappears permanently the assumption is justifiable that it was not a cancer.

On the other hand, there are even transplantable mouse tumors with such high virulence that they do not disappear at all, but act in any host as if no restraints existed against their growth.

It was long since shown that no artificial immunity can be produced against a transplanted tumor, once it starts to grow. If the animal chooses to make the tumor's life uncomfortable by refusing it food, that is one thing, but we have no means of influencing this process; hence the doubtfulness of ever being able to treat human tumors with serums or medicines. Certainly nothing which has been produced so far has offered the slightest hope that a solution of the cancer problem in that direction is even on the horizon.

In other directions, the study of animal tumors has strengthened some old beliefs and cast new light upon present problems. For example, the fact that transfusion or injection of blood in an animal carrying a tumor tends, if anything, to increase the growth rate should certainly put a quietus on similar attempts in man.

Yet the daily press teems with notices of new serum cures for cancer. The serum usually enjoys a period of success for about a year, at the expiration of which time, all those who have been treated having died, the cure is abandoned. It is unfortunate that there is no method to compel the test of all cures on animal tumors first: much human suffering would be thus spared.

Again, the study in mice of the influence of massage in the distribution of tumor cells all about the body has called attention to the gravity of the existing situation due to the extensive use throughout the country of massage and manipulative methods for all sorts of disease, including cancer.

The problem of the advisability of a biopsy in suspected cancer, where a diagnosis can be made by no other means, has been clarified by experimental studies.

Finally, the study of the effects upon tumors of various forms of physical energy such as heat, radium or the roentgen ray, has cast much light upon this difficult therapeutic problem and will in the near future no doubt furnish more.

These are the achievements of the past. What about the future?

It would seem that the most important immediate step would be the discovery of some generally applicable means of diagnosis of cancer by some chemical or biological test.

If the growth of the fetus causes changes in the metabolism of the mother it should be expected, and has, in fact, been found, that similar changes occur in the metabolism of animals and human beings bearing tumors. Should these changes be shown to be sufficiently characteristic in the early stages of the disease instead of only in its terminal phase, as we now see them, the present methods of cancer therapy would instantly increase in their range of usefulness, because the great defect in the therapy of to-day is that we are, in such a large proportion of cases, too late.

If such a diagnostic means, no matter how complicated or difficult, can be discovered, then a great step will have been taken and we may await with somewhat less impatience the ultimate though possibly far distant discovery of a medicinal cure.

FRANCIS CARTER WOOD.

PROPOSED SECTION OF RADIOLOGY OF THE AMERICAN MEDICAL ASSOCIATION

The Council on Scientific Assembly of the American Medical Association, of which Dr. J. Shelton Horsley of Richmond, Va., is Chairman, has recommended that there be two sessions of Radiology under Miscellaneous Topics at the next meeting of the American Medical Association.

Dr. Willis F. Manges of Philadelphia has been appointed Chairman, Dr. Albert Soiland of Los Angeles, Vice-Chairman, and Dr. Maximilian J. Hubeny of Chicago, Secretary.

Further consideration of the formation of a full section in the American Medical Association will undoubtedly depend upon the attendance and enthusiasm shown at these two sessions under Miscellaneous Topics.

There are numerous considerations that make highly desirable the formation of a permanent Section of Radiology in the American Medical Association. Chief among these is the opportunity it would afford for radiologists to come into closer contact with the great body of clinicians in all branches of medical practice.

There seems no doubt that such contact would not only broaden the roentgenologist's outlook and make him much better able to cooperate with his confréres in clinical medicine, but it would obtain for him a hearing by men in all other lines that he cannot hope to secure in meetings confined to men of his own specialty.

The American Medical Association has always been liberal and progressive along sound lines in its recognition of new methods for the diagnosis and treatment of disease. Its recognition of radiology as

an integral part of medicine may have seemed somewhat belated to those whose entire lives have been given to the practice of this specialty, but it should be remembered that it is less than thirty years since the roentgen ray was discovered, and that progress has been gradual through these years.

A great opportunity is now offered to roentgenologists and radium therapists to cooperate with the rest of the medical profession, and the officers who have been appointed earnestly solicit the aid and advice of all in order to assure a successful meeting this year.

PEPTIC ULCER AND ROENTGENOTHERAPY

The feeling of enthusiasm in regard to short-wave therapy that swept the medical world after the close of the war has quietly cooled down to a more rational basis. Since then we in this country have been plodding along, establishing to our own satisfaction the most that we can really expect from this form of treatment.

The extravagant claims of the German school have not been entirely borne out. For example, there have appeared in the last two years in German medical literature a number of papers upon the treatment of peptic ulcer. All the authors report about 75 to 85 per cent of cures, some working with single doses and others with divided doses. Both these methods have been thoroughly tried out by us with special attention to technical detail and our results have been almost complete failures. Some of the patients have even been made worse both in subjective and objective symptoms.

We believe that we should be very cautious with so powerful an agent, realizing fully that the possession of a short-wave therapy machine does not give us the moral right to use it indiscriminately.

ERNEST C. SAMUEL.

As we go to press word is received of the sudden death of Sir Archibald Reid, K. B. E., C. M. G.

Subscribers to THE AMERICAN JOURNAL OF ROENTGENOLOGY AND RADIUM THERAPY *visiting New York City, are invited to make the office of* THE JOURNAL (69 *East 59th Street, New York) their headquarters. Mail, packages or bundles may be addressed in our care. Hotel reservations will gladly be made for those advising us in advance; kindly notify us in detail as to requirements and prices. List of operations in New York hospitals on file in our office daily.*

SOCIETY PROCEEDINGS, CORRESPONDENCE AND NEWS ITEMS

Items for this column solicited promptly after the events to which they refer.

ANNUAL MEETING, EASTERN SECTION, AMERICAN ROENTGEN RAY SOCIETY

The Eastern Section of The American Roentgen Ray Society held its fifth annual meeting in Atlantic City on January 24, 25 and 26, 1924, under the chairmanship of Dr. Thomas A. Groover of Washington, and with Dr. W. C. Wescott of Atlantic City as secretary.

The meeting was characterized from beginning to end by unusually enthusiastic discussion of the subjects presented.

It is impracticable at this time to make a complete report of all the papers presented, but the following is a brief résumé of some of the important points emphasized by various contributors to the program.

Discussion of a paper by Drs. Lattin and Perkins on "The Differential Diagnosis of Cardiac Enlargement and Pericarditis with Effusion" brought out a marked difference of opinion regarding the possibility of demonstrating the heart shadow within the pericardial shadow. Several believed this possible, while others thought it not only physically impossible, but that there are other shadows, such as those cast by encapsulated mediastinal collections of fluid which may be present at the same time as pericarditis with effusion, which may stimulate the heart shadow.

Dr. Samuel presented a paper on "The Roentgen Diagnosis of Aneurysm of the Aorta" based upon his extensive experience as roentgenologist for Dr. Rudolf Matas. He stated that he had never been able to demonstrate an aneurysm below the diaphragm, no matter what the type, by the aid of the roentgen ray. He emphasized the importance of careful roentgenoscopic and roentgenographic examination of the aorta of *all* patients in various positions when they are referred for either chest or gastrointestinal examination.

Drs. Thomas and Farmer presented a very comprehensive paper on "The Diagnosis of Primary Intrathoracic Neoplasms" giving a thorough study of cases from the clinical as well as the roentgenologic standpoint.

The paper by Dr. George W. Holmes on "Massive Collapse of the Lung" was based upon a study of 4 such cases at the Massachusetts General Hospital since the case reported from that hospital by Ritvo in 1922. The disease "usually involves an entire lobe and not infrequently the whole of one lung. Symptoms may be present or absent. They may be of extreme urgency or of only moderate severity. In practice, it is most often seen following abdominal operations, especially for hernia and appendicitis. Its cause is not entirely understood but it is frequently accompanied by a partial or complete paralysis of the diaphragm on the affected side." Displacement of the heart to the affected side is a common roentgen finding and this is usually accompanied by a high, rigid diaphragm with increased density in the affected portion of the lung, and by narrowing of the intercostal spaces on the affected side.

Dr. Walton's paper on "Malpositions of the Diaphragm with Report of a Case of Eventration" was an especially clear description of the roentgen appearance in eventration, and is of additional value because of a very complete bibliography accompanying it.

The paper by Dr. Manges on "Atelectasis as a Roentgen-Ray Sign of Foreign Body in the Air Passages" was another contribution out of a unique experience in the study of foreign bodies in the air passages. He emphasized especially the necessity for roentgen study of a suspected case in both inspiration and expiration.

The paper by Dr. Sosman on "The Roentgenological Diagnosis of Craniopharyngeal Pouch Tumors" is published in this issue of the JOURNAL.

Dr. Pfahler's paper on "The Study of the Sternum by the Roentgen Rays" calls attention to a neglected field in roentgenography. He demonstrated the possibility

of diagnosing metastasis or direct extension of malignant disease to the sternum from the breast, pleura, or mediastinum.

Dr. Witherbee in a paper on "Roentgen Therapy in Tonsillitis and Pharyngitis," called particular attention to the necessity for treating these cases in the proper positions and at the correct angles.

In a paper on "The Relation of Blood Types to Malignant Disease and The Influence of Radiotherapy" Drs. Pfahler and Widmann give a summary of experimental work on this subject. Their conclusions are as follows:

1. With our present knowledge of the technique of differentiating blood types, we find there is no relation between blood types and malignant disease.

2. The percentages established by Moss, Culpepper, Bernheim and Buchanan are only approximate and capable of considerable variation without particular significance.

3. Individuals of all four blood types are liable to suffer from malignant disease.

4. Individuals of Groups I and III are not more susceptible to malignant disease than others.

5. The type of blood has no relation to the degree of malignancy.

6. Neither radiation, roentgen sickness, nor the evolution of a malignant process, retrogressive or progressive, can alter a blood type.

7. Possibly some future refinement in the study of isohemagglutinins may detect some change heretofore unrecognized.

A paper which gave rise to much discussion was that on "A Case of Hodgkins" Disease, with Late Development of Sacroiliac Disease, Cured by Roentgen Treatment" by Drs. Pfahler and O'Boyle. The case reported had bone involvement in the sacroiliac region following extensive Hodgkins' disease in the chest; the bone lesion disappeared completely under roentgen-ray treatment. In the discussion a number of members reported similar cases.

Drs. Leddy and Weatherwax in a paper on "Palliative Doses of Roentgen Ray in Advanced Cancer" state the following conclusions:

1. Inasmuch as "Erythema," "Carcinoma" and "Sarcoma" doses have no absolute value, dosimetry on a basis of these is an arbitrary technique.

2. In advanced cancer roentgen-radiation with the technique of fractional doses applied at intervals has given satisfactory results.

3. The supposition is advanced that in more favorable cases of carcinoma a similar technique may be as effective as more intensive, radical therapy.

Dr. Quick contributed a paper on "Some Considerations in the Treatment of Carcinoma of the Esophagus," in which he emphasized especially the necessity for an early gastrostomy and early direct examination through the esophagoscope. He gives the following conclusions:

1. Carcinoma of the esophagus is a disease in which we can hope for palliative relief only.

2. An early gastrostomy offers the major portion of this relief.

3. External radiation, preferably with high voltage roentgen-rays, aids in slowing up the rate of tumor growth, but so far has not controlled it.

4. Intra-esophageal application of radium, preferably in small repeated doses, is indicated to control ulceration and bleeding locally, but has little influence on the actual progress of the disease.

Many other interesting and valuable papers were read and discussed. They, as well as those mentioned above, will be published in the JOURNAL within the next few months. The meeting, on the whole, was thought by those in attendance to be one of the most profitable the Society has ever had.

At the concluding session the following officers were elected for the ensuing year: President, Charles Eastmond, Brooklyn, N. Y.; Vice-President, Ralph Leonard, Boston, Mass.; Secretary, Fred M. Hodges, Richmond, Va.

BRITISH INSTITUTE OF RADIOLOGY

The following extracts from a letter from Sir Archibald Reid to Dr. Wm. H. Stewart explaining the organization and objects of the British Institute of Radiology will be of interest to many of our readers: ". . . we hope to make the Insti-

tute a central body to act as a clearing house for British Radiology and a central bureau for the collection, correlation and distribution of our radiological activities. The house of the Institute is a suitable one for these purposes and we hope to have it ready to start work in October of this year (1923). We hope to make it useful to our members and also to our colleagues from other countries who may visit us, in providing a convenient place for them to obtain any assistance necessary in carrying out their program.

"It is proposed to form a radiological museum and to equip the library, and it is especially in this connection that we should be grateful to your members for books of reference and reprints of articles, and also skiagrams especially in the form of lantern slides of cases of interest (verified) and of cases where the rarity of the condition makes diagnosis problematical or doubtful. Any assistance of this kind would be very highly appreciated by the Committee of Management.

"We should also very cordially welcome members of your Society if they should wish to become members of the Institute."

A circular accompanying Dr. Reid's letter explains that the British Institute of Radiology is being organized by a committee representing the Royal Society of Medicine, the Röntgen Society, and the British Association for the Advancement of Radiology and Physiotherapy.

A lease of suitable premises for the Institute has been consummated.

"The aims and objects of the Institute may be briefly summarized as the provision of a professional center for research and education in the application of *x*-rays, radium and kindred agencies in medical practice."

PROF. FORSSELL JOINS OUR FOREIGN COLLABORATORS

It is with great pleasure that the Journal announces the addition of Prof. Gösta Forssell of Stockholm, Sweden, to the list of our foreign collaborators.

Prof. Forssell's work and the excellent publication, Acta Radiologica, of which he is editor, are so well known to roentgenologists in this country that no comment is necessary.

RADIUM SOCIETY MEETING

The American Radium Society will hold its Ninth Annual meeting at the Drake Hotel, Chicago, Illinois, June 9 and 10, 1924. Those members who expect to attend the American Medical Association meetings at the same time, will find the Drake Hotel one of the most up-to-date and conveniently located hotels in Chicago, especially in relation to the exhibits and scientific sessions of the American Medical Association. Reservations can be made immediately through the Arrangement Committee of the American Radium Society by addressing Dr. Henry Schmitz, 25 East Washington St., Chicago.

The scientific sessions of the American Radium Society will be held at the Drake Hotel. Further information regarding the program and clinics will be announced when the arrangements have been fully completed.

BRITISH JOURNAL CHANGES ITS NAME

"Beginning with January, 1924, the name of the Archives of Radiology and Electrotherapy was changed to The British Journal of Radiology and is the official organ of the British Association of Radiology and Physiotherapy. The size has been changed practically to that of The American Journal of Roentgenology and Radium Therapy. The American Agency has been placed in the hands of Paul B. Hoeber, Inc., Publisher of The American Journal of Roentgenology and Radium Therapy, to whom subscriptions may be sent."

DEPARTMENT OF TECHNIQUE

Department Editor: DAVID R. BOWEN, M.D., Pennsylvania Hospital, Philadelphia, Pa.

In this department will be published from time to time, as material is available, suggestions for improvement in technique.

APPLICATION OF THE ULTRAVIOLET LIGHT WITH QUARTZ LAMPS TO THE PERINEUM IN SKIN AFFECTIONS

BY CARLOS HEUSER, M.D.

BUENOS AIRES, ARGENTINA

THE use of quartz lamps with the ultraviolet light, in addition to roentgen-ray applications, is the most efficacious treatment for eczema of the perineal region, vulva, anus, etc.

As will be seen by the illustrations, the seat of the chair in question has an opening through which the rays of quartz light pass, and beneath this opening at a distance of 40 cm., there is the lamp which is

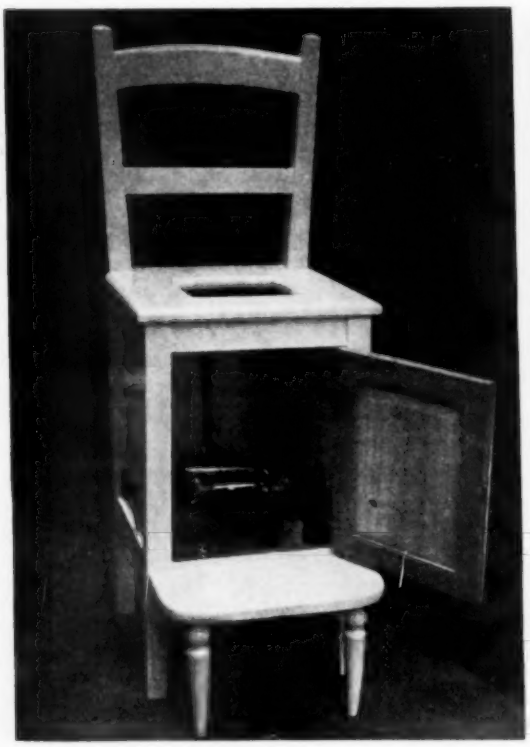

FIG. 1.

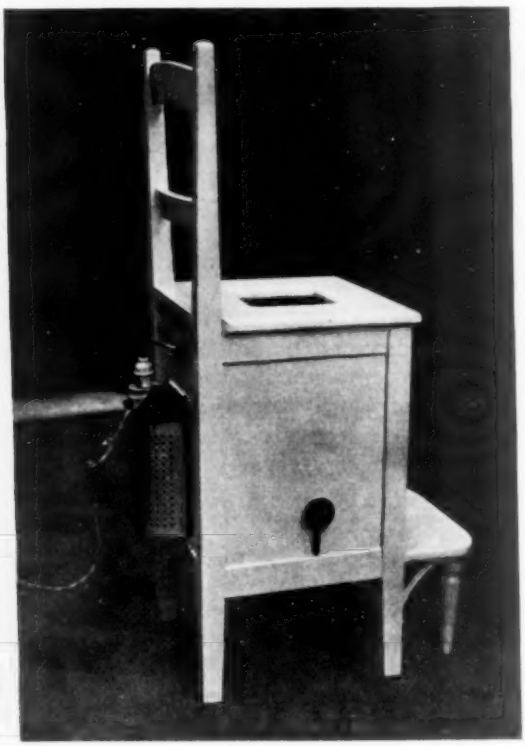

FIG. 2.

Finding that with our ordinary apparatus it is difficult to make the applications conveniently for an extended length of time in the region of the perineum, I conceived the idea of placing the lamps of quartz in a chair, where the patient can receive the light while in a seated position.

manipulated from outside. The lamp is enclosed in a box fitted into the space within the four legs of the chair.

In this manner the patients are able to sit with the affected part over the opening of the chair and receive the ultraviolet light treatment during five, ten or thirty-five minutes with comfort and ease.

EXTRACTION OF FOREIGN BODIES IN DAYLIGHT WITH ROENTGEN RAYS

BY CARLOS HEUSER, M.D.

BUENOS AIRES, ARGENTINA

I HAVE modified the principle of Doctor Grasley's table in an effort to carry out a roentgenoscopic examination, during the act of operating to extract a foreign body, while with the free eye the surgeon can see to direct the operation that is being performed.

Hitherto this was not feasible, as it was either necessary to perform the operation in a dark room or else direct one of the assistants to guide the surgeon with roentgenoscopic control, a process which was awkward and difficult.

When the surgical cleaning has been done and that part of the patient which contains the foreign body has been adjusted on the table above the roentgen-ray tube, the operation may proceed, the tube being illuminated as may be necessary.

Through the opening of the apparatus the surgeon can, with one eye, observe the relation of different organs to the foreign body as he operates, while with the other eye he can follow his own movements, until the foreign body is reached. Then

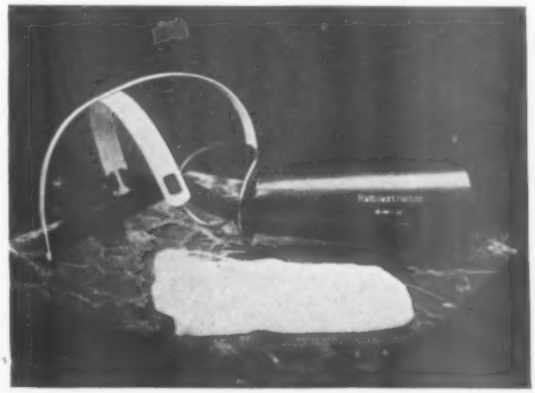

FIG. 1.

FIG. 2.

The apparatus consists of a metal frame which is conveniently adjusted to the face by means of an elastic band put over the head.

To this metal frame an aluminum tube is soldered, at the end of which there is a roentgenoscopic screen with its leaden eye piece, so that one eye is free, while the other is covered with the tube.

On this tube there is placed, during the operation, a strip of sterilized gauze, so that the surgeon may be able to handle the tube or touch the wound.

To use the tube, roentgenograms are taken in order to ascertain and to mark the spot which is most capable of being attacked in relation to all the neighboring organs.

under the double control of the rays and eyesight, it can be extracted.

During the act of operating it is not necessary to illuminate constantly with the rays, but only from time to time, and for a few seconds, since the object is merely to establish the relationship and guide the surgeon as to the track he must follow till the foreign body is reached.

After the foreign body has been extracted an assistant removes the helmet from the surgeon who continues the operation in accordance with requirements.

The apparatus may be used not only to remove a foreign body; but also in various bone operations while operating, one can plainly see on the screen how he is proceeding.

A DEVICE FOR CENTERING THE PATIENT BEFORE THE UPRIGHT STEREOSCOPIC PLATE-CHANGER

BY EDWARD S. BLAINE, M.D.

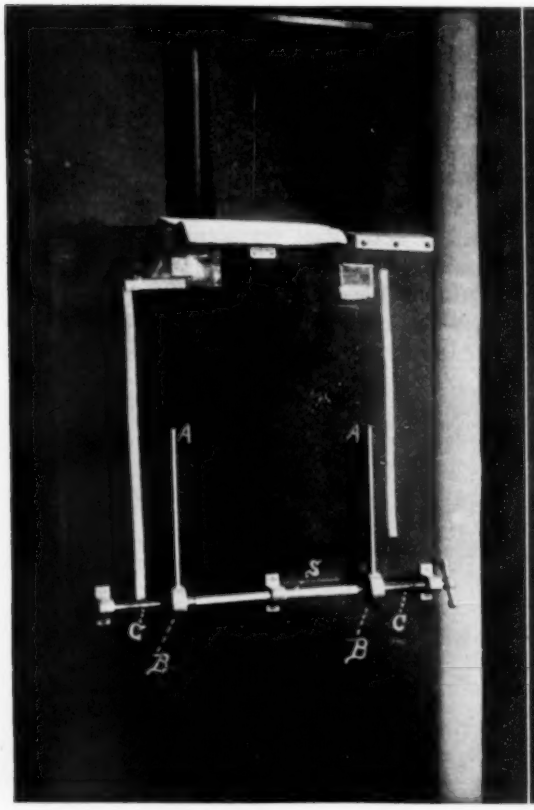

FIG. 1.

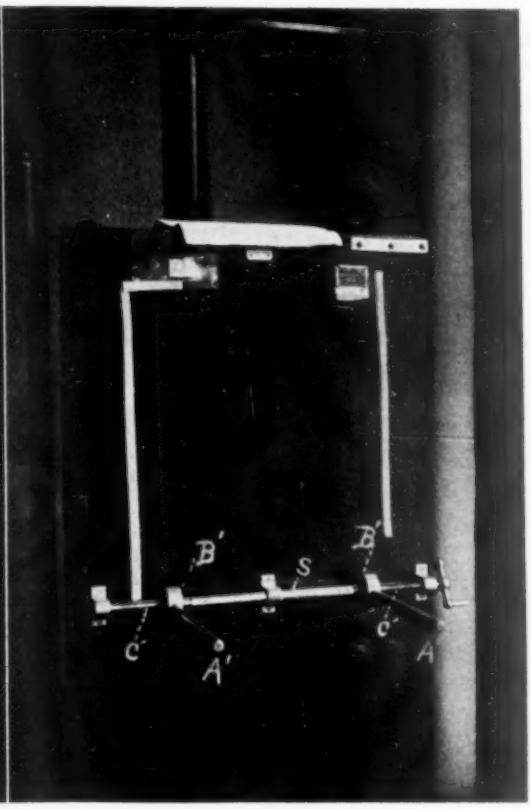

FIG. 2.

THE main feature of this, is a rod so threaded that the centering arms which it carries are moved symmetrically from or toward the center by turning the rod. The nuts which carry these centering rods are so notched as to permit the rods to stand out at right angles to the plane of the film, or to be turned vertically upward against the plate changer and thus out of the way. The illustrations and legends are self-explanatory.

A-A′ Centering rods.

B-B′ Stop notches in centering rod carrier nuts.

C-C: C′-C′ Right-hand and left-hand threading on screw-rod.

D The rectangular base (shown only in the diagram).

S The screw-rod.

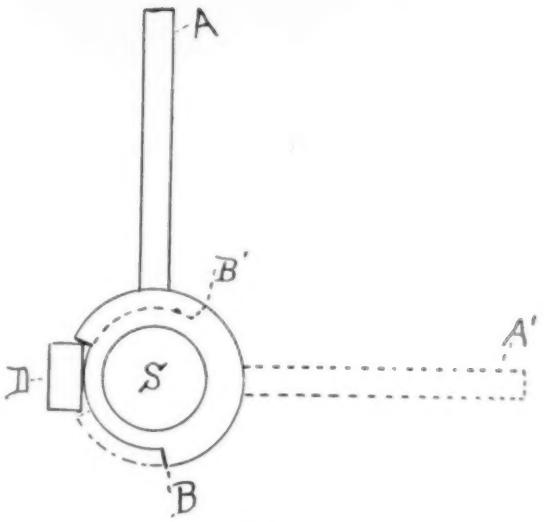

FIG. 3.

BOOK REVIEWS

DENTAL AND ORAL RADIOGRAPHY. A TEXTBOOK FOR STUDENTS AND PRACTITIONERS OF DENTISTRY. By James David McCoy, M.S., D.D.S., F.A.C.D., Professor of Orthodontia and Radiography, College of Dentistry, Univ. of Southern California. Price $3.25. 194 pages and 116 illustrations. 3d Ed. C. V. Mosby Co., St. Louis, 1922.

The author states in the preface to the second edition that he feels within reasonable bounds when he states that "the *x*-ray has done more to improve dentistry than any other agent that has come into it during the past ten years."

In the prefaces to the various editions, emphasis is laid upon the fact that the book has been written primarily as a textbook for students of dentistry. It admirably fulfills the author's purpose in this respect. The book is written in a clear, simple style and develops the subject in a logical manner especially adapted to the needs of the student.

The entire subject is dealt with in such a complete manner, however, that a reading of the book will repay even the experienced roentgenologist.

The chapters on technique, giving careful detailed descriptions, illustrated by numerous drawings and photographs, and the chapters on interpretation and indications for the use of roentgenography in dental practice, seem to the reviewer to merit special mention.

INTERPRETATION OF DENTAL AND MAXILLARY ROENTGENOGRAMS. By Robert H. Ivy, M.D., D.D.S., F.A.C.S., Professor of Maxillo-Facial Surgery, Graduate School of Medicine and Clinical Maxillo-Facial Surgery, School of Dentistry, University of Pennsylvania, Lt. Colonel, Medical Reserve Corps, United States Army: and LeRoy M. Ennis, D.D.S., Instructor in Radiography, School of Dentistry, University of Pennsylvania; Captain, Dental Reserve Corps, United States Army. Price $4.00. 195 pages and 403 illustrations. 2d Ed. C. V. Mosby Co., St. Louis, 1923.

As the title indicates, this book deals almost entirely with the interpretation of dental and maxillary roentgenograms. In the interests of uniformity and clearness the attention of writers is directed to the following sentence in the introduction: "The American Roentgen Ray Society, which may be properly taken as the official representative of this branch of medical science in the United States, has adopted in honor of Roentgen, the discoverer, a nomenclature which I consider it advisable to follow."

The book covers the subjects of the normal anatomy of the teeth and jaws and their roentgen appearances, pathology from the clinical and roentgenographic examination. There are chapters on stereoscopic roentgenography and on roentgenographic findings in relation to prognosis and treatment. Probably the most valuable part of the book is the large section given to detailed description and interpretation of numerous roentgenograms.

DIATHERMY AND ITS APPLICATION TO PNEUMONIA. By Harry Eaton Stewart, M.D. Price $3.00. 226 pages, 45 illustrations and 15 charts. Paul B. Hoeber, Inc., New York, 1923.

This is a concise account of the physics of diathermy and of the apparatus for production of the bipolar high frequency current of D'Arsonval.

A chapter is devoted to a short description of the uses of diathermy in surgery.

Numerous case histories are given to demonstrate the effect of diathermy upon patients with pneumonia. The technique of the treatment is described and its beneficial results shown by mortality and other statistics.

MEDICAL AXIOMS, APHORISMS AND CLINICAL MEMORANDA. By James Alexander Lindsay, M.A., M.D., F.R.C.P., Professor of Medicine in the Queen's University of Belfast, Consulting Physician to the Royal Victoria Hospital, Belfast and to the Ulster Eye, Ear and Throat Hospital. Price $2.25. 192 pages. Paul B. Hoeber, Inc., New York, 1923.

This collection of short, pithy axioms and aphorisms from the time of Hippoc-

rates and Aristotle to that of William Osler and G. Bernard Shaw is interesting and stimulating.

The clinical memoranda based on the author's own experience as an observer and teacher are of real practical value. A few of them, however, might be considered somewhat belated. Surgeons would hardly agree, for instance, to place surgery in a subordinate position to medicine in the treatment of exophthalmic goiter.

RADIODONTIA (Dental Radiography and Diagnosis) QUESTIONS AND ANSWERS. By Howard Riley Raper, D.D.S., formerly Professor of Radiodontia, Materia Medica, and Operative Technic, and Junior Dean, Indiana Dental College. Price $4.50. 179 pages, with 52 illustrations. Dental Items of Interest Publishing Co., New York, 1923.

The method and aim of this book is indicated by the following quotations from the preface. "Broadly speaking, the study habit is simply the habit of asking one's self questions; then looking up the answer."

"The questions-and-answers form is a convenient one; the reader may glance at the question; then, if he is sufficiently interested, read the answer."

"By adopting this method of presenting the subject I have been able to include a great deal in a comparatively small space. . . ."

The book is intended for students of radiodontia, both graduates and undergraduates, and as a guide for teaching the subject. The form of questions and answers lends itself especially well to the latter purpose. The volume covers the subject of dental roentgenology very thoroughly, including description of apparatus, details of technique, interpretation and differential diagnosis. A good index renders the book useful for reference.

THE AMERICAN ANNUAL OF PHOTOGRAPHY, Vol. xxxviii. Edited by Percy Y. Howe. Cloth. Price $2.50. 296 pages. The American Annual of Photography, Inc., Yonkers, N. Y, 1923.

After reading this admirable annual one again turns to the editor's preface in complete accord with the statement that: "Photography has at last reached a position where we can truthfully say it has a place in all our lives whether we are actively engaged in it or not."

The volume contains many contributed articles, some of which should be especially interesting to the roentgenologist, and the appendix is replete with tables and formulae which in themselves render the work highly desirable to anyone concerned in "dark-room" problems.

Profusely and beautifully illustrated.

NOSOGRAPHY IN MODERN INTERNAL MEDICINE. By Knud Faber, M.D., Professor of Internal Medicine, University of Copenhagen. With an Introductory Note by Rufus Cole, M.D., Director of Hospital, Rockefeller Institute. Cloth. Price $3.75. 235 pages, with 21 full page illustrations. Paul B. Hoeber, Inc., New York, 1923.

This book is a review of the history of clinical medicine from the time of Sydenham, with special reference to the influence of nosology upon its progress.

Nosology or nosography is defined as "the description of diseases." The author considers it the very keystone of medical progress. Although he does not minimize the importance of a knowledge of symtomatology, pathology, bacteriology, etc., he attempts to show that all of these are of importance in medical progress only as the information gained from them enables the clinician to describe each disease more accurately.

In the introductory note, Dr. Cole writes as follows:

"Through an historical study the book attempts to formulate the idea of what clinical medicine really is, and it therefore forms a definite starting point for thought and discussion. That it will give rise to these is certain.

"Moreover, besides presenting in a clear and consecutive manner the history of internal medicine, the book indicates very clearly the lines along which clinical medicine is developing today. It is, therefore, of great value even to those who are not interested in the more philosophical problems which are discussed."

INTERNATIONAL ABSTRACTS OF ROENTGEN AND RADIUM LITERATURE

SERGENT, EMILE, AND COTTENOT, PAUL. Radiological explorations of the respiratory apparatus after intratracheal injection of lipiodol. (L'exploration radiologique de l'appareil respiratoirè apres injection intratrachéale de lipiodol.) *J. de radiol. et d'electrol.*, Oct., 1923, vii, 441.

The method proposed by Sicard and Forestier, make it now possible to render the tracheobronchial tree opaque by the injection of lipiodol.

Lipiodol is poppy oil 40 per cent, containing 0.54 gm. of iodine to the cubic centimeter. This is very opaque to roentgen ray on account of its high iodine content, and it is perfectly tolerated.

Technique. Lipiodol may be introduced into the trachea through the glottis or below it. The transglottis route can be used only by expert use of the laryngeal mirror after cocaine anesthesia of the larynx. For that reason, the authors preferred the route below the glottis, using a 40 c.c. strong metallic syringe and a curved needle, piercing the trachea through the cricothyroid membrane. Tracheal anesthesia was necessary in order to avoid the cough. They injected 20 c.c. at first and in some cases have increased it to 40 c.c. without inconvenience. The position of the patient varies with the part of the lung to be injected; when seated the lipiodol fell directly into the lower bronchi, principally the right inferior; in lateral decubitus, the lower side, filled first; in dorsal decubitus, the right side filled first.

In order to reach the summit it was necessary to lay the patient on the back or side with hips elevated and shoulders down on the incline. The position varies with the aim sought. The roentgenography should be done at once when the lipiodol is in place, reducing the movements of the patient to an indispensable minimum before taking the negative. Movements are liable to produce cough and thus expel the lipiodol.

The authors had not observed any serious accidents due to filling the trachea and bronchi with lipiodol, and none has been noted by others using this method.

Elimination of lipiodol. The greater part of the lipiodol is eliminated within two hours after the examination. The movements of getting up and dressing cause a cough and the lipiodol is expectorated or ingested. It can be shown in the stomach by screen examinations. In three or four days none is left in the lung, though in some subjects it may remain for a much longer time. Sicard and Forestier found it three or four months after the examination. From one-half to two-thirds of the lipiodol is ejected by the cough and the remainder is absorbed by the mucous membrane, as is proven by the iodine in the urine.

Two of the authors' patients presented slight signs of iodism for forty-eight hours, consisting of a swelling of the face, watering of the eyes, and in one, painful swelling of the salivary glands. The saliva of both contained iodine.

Lipiodol injected for therapeutic purposes can be found at the point of injection two years later.

Data is furnished of normal roentgenological anatomy of the respiratory apparatus by injections of lipiodol.

Conclusions. Lipiodol permits the study on the living man of the form and trajectory of the bronchial trunks.

The authors found the large left trunk bronchus and the bronchus of the left lower to be completely hidden behind that of the heart, and descending parallel with the left ventricular border and within its shadow. Therefore, it is impossible to see them from the front, but their whole length can be seen from a right anterior oblique position. The lipiodol marks out the bronchial tree to the small branches.

In the plates obtained by lipiodol, one clearly differentiates the bronchial shadows from those of the hilum.

The lesions which lipiodol makes evident are:

(1) Deviations of trachea and bronchi.
(2) Modifications of permeability of a bronchial area.
(3) Dilatation of the bronchi.
(4) Pulmonary cavities.
(5) Bronchial and pleural fistulæ.

SESSA, P. A case of sarcoma of the ulna. *Radiol. med.*, 1923, x, 242.

A patient forty-three years of age, suffered from pain in the region of the right olecranon. Aside from the pain, there was a heavy feeling, but neither swelling nor redness. The arm was kept quiet, but soon severe pain on slight traumatism developed very rapidly in the forearm. A surgeon pronounced it a fracture of the olecranon. After forty days of immobilization the patient felt much better, and this condition continued for six months. When he became worse roentgen examination was made,

and the upper third of the elbow was found deformed. The olecranon was changed into a vacuolized bony mass. Its outer border was sinuous and irregular. Light zones of bone rarefication were interspersed between bone trabeculæ. This mass was divided from the ulnar diaphysis by a tortuous, irregular, lighter line. In some parts the structure was entirely decalcified. No signs of periosteal change were seen.

The Wassermann reaction was negative. A surgical intervention for diagnostic purposes was made. In the epiphyseal structure a cavity of the size of a nut was found, which was partly fibrous and partly osseous. Granulomatous-looking tissue was found inside of it, which bled easily. The examination of the specimen showed a myelogenous sarcoma, with polymorphous cells. The upper third of the ulna was resected. Three weeks later radiation with the erythema dose, from the external and internal borders was made at a focal distance of 40 cm. with 200,000 volt tension, and with 2 ma. The filtration employed was ½ mm. Zn. and 1 mm. Al. The elbow was immobilized at a right angle, and in six months the roentgenogram and general state were very satisfactory.

VEAU, VICTOR. Surgery and radiotherapy of the thymus. (Chirurgie et radiotherapie du thymus.) *J. de. radiol. et d'electrol.*, Par., Oct., 1923, vii, 450.

This report is only on the hypertrophies of early infancy, and does not consider cases of benign or malignant tumors of the thymus developed in the adolescent or adult, nor chloroform deaths found on autopsy to have a large thymus.

Surgery has failed in these cases and irradiation should replace it. Reference is made to cases in which thymectomy had been done on patients who were really suffering from tracheobronchial adenopathy with disseminated tuberculosis.

STONE, W. S., AND EWING, JAMES. An unusual alteration in the natural history of a giant-cell tumor of bone. *Arch. Surg.*, Sept., 1923, vii, 280.

SUMMARY

The record of the case presented is of interest from several aspects. The transformation of the structure of a benign giant cell tumor, while evidently very rare and not previously recorded in this disease, finds a parallel in similar transformations that have occurred in many other tumors, benign and malignant, after surgical and other forms of trauma.

The development of metastases in this case proves no exception to the rule that the benign giant-cell tumor never produces metastases. Here, the metastasizing tumor was not a giant-cell tumor, but a malignant growth that developed out of a giant-cell growth, as the result of various insults, in which curettage and imperfect irradiation probably played the chief part.

Our search of the literature seems to show that there is no satisfactory record of metastasis of a giant-cell tumor in its original form. That such metastases have not been recorded among the great number of these tumors that have been subjected to repeated curettages seems to us a matter of surprise.

The occurrence of metastases in this case seems to stand as a somewhat hazardous feature of the usual surgical treatment of the benign giant-cell tumor and as evidence in favor of the treatment by external radiation.

The unfortunate outcome in this case suggests that the surgical plan of treatment, if adopted in these cases, should be adhered to, and that it is unwise to attempt to combine surgical methods with postoperative radiation by means of radium inserted in the tumor cavity.

STEINFIELD, EDWARD, PFAHLER, GEORGE E., AND KLAUDER, JOSEPH V. Clinical and roentgenologic study of one hundred and five cases of syphilis with reference to the cardiovascular system. *Arch. Int. Med.*, Oct. 15, 1923, xxxii, 556.

SUMMARY

A brief review of the literature on cardiovascular syphilis is made. The pathology of syphilitic aortitis is discussed.

The symptomatology of syphilitic aortitis is presented with particular reference to early symptoms. The importance of an early diagnosis is emphasized.

Of a group of 105 male syphilitic patients studied by clinical methods, 60 were white and 45 negroes. They varied in age from twenty-two to fifty-nine years, and the duration of syphilitic infection varied from one to twenty or more years. Approximately, one-fourth were between forty and fifty years of age. Twelve patients, approximately 10 per cent, were found to be suffering from aortic or myocardial disease. Of these, 3 were white and 9 negroes. Of the aortic lesions, one was diagnosed as aortitis, two as aortic dilatation, six as aortic dilatation and insufficiency and two as aneurysm.

Of 63 patients studied by roentgenologic methods, aortic disease (including aneurysm) was noted as being definitely present in 19 or 33 per cent. Roentgenologic examination

included fluoroscopy, teleroentgenograms made at a distance of 2 meters, and oblique films. The higher percentage of patients with aortic disease discovered by roentgenologic examination is in accord with pathologic studies reported by others and reviewed in this report.

The so-called Wassermann-fast syphilitic patient is discussed with particular reference to cardiac syphilis.

Of a total number of 25 patients with neurosyphilis, there was an associated aortic disease in 4. The relative infrequency of an active syphilitic process involving one or more systems in the same patient is discussed.

LISS, L. EDWARD. A roentgenological study of tuberculosis of the lungs and intrathoracic glands in infancy and childhood. *Am. J. M. Sc.*, Sept., 1923, clxvi, 396–402.

Tuberculosis in infancy is of two types, acute and chronic. The first is the more common of the two and may be subdivided into:

(1) Tuberculosis of the glands.

(2) Tuberculosis of the lungs.

In both cases, by means of the roentgen-ray follow-up, the process can be shown to have a definite and fairly orderly sequence: a period of congestion, a period of retraction or spreading, complete or incomplete, and a period of softening. While it is true that in the early or congestive stage, the process may not be distinguishable from any of the acute infections, in the second stage, that of retraction or expansion, the conditions assume characteristic appearances; and in the third stage there should be no difficulty in the diagnosis. For exact visualization of these changes repeated roentgenographic investigation is absolutely essential.

HEUSER, CARLOS. *X*-ray toxemias. (Toxemias roentgeniana.) *La Semana Medica*, Aug. 16, 1923, xxx, 309.

Roentgen rays produce in the body the following effects: (1) Local disturbances–roentgen dermatitis; (2) general disturbances—vomiting, diarrhea, debility, drowsiness, discomfort, and fatigue; (3) late manifestations—trophoneurotic ulcers, coming on a year after the application, toxemias, nausea, and vertigo which come from six months to a year after the cessation of treatment.

The first two effects have been studied, but the third has been reported in only isolated instances, without being classified or described.

The rays used to cure a superficial lesion do not attack the organism if they do not exceed a certain biological dose, but the rays applied with a cellular destructive dose produce in the organism a local radiodermatitis according to the dose, up to ulceration. They should be applied only in exactly measured dose, previously determined.

The general disturbance due to the elimination of the cellular detritus may be diarrhea or vomiting from gastrointestinal irritation; dryness, irritation, and painful breathing due to the effect on the respiratory tract; or nausea and vertigo from cerebral irritation.

All of these lower the vitality of the patient, and it must be remembered that the effect accumulates when enough time has not been allowed for the organism to recover.

These general disturbances (vomiting and diarrhea) are not only symptomatic of epithelial or mucous lesion, but of a disturbance of the endocrine system—ovaries, thyroid, thymus, or suprarenal capsule.

A case is reported of recurrent cancer of the breast in which there was given a roentgen dose of intense erythema over the chest and shoulder. Six months afterward a roentgenogram of the lung showed various small round shadows due to pulmonary sclerosis. The patient died of cancer of the mediastinum. The autopsy showed sclerosis of the pulmonary parenchyma which corresponded to the area treated. These sclerotic areas were formed by connective tissue which enclosed not only the vessels, but principally the bronchioles. They contained no cancer cells.

In various cases, late trophoneurosis was observed, although the cases had not received a lethal cancer dose.

This gangrenous degeneration is observed principally in locations where there is bone. Secondary rays from the bone unite with the direct rays to produce the total effect.

Conclusion. Roentgen therapy may produce disturbances which manifest themselves a year or more after the treatment. These manifestations are in the nature of a trophoneurosis resulting in mummification of the skin and dry gangrene of the entire locality. The process is cured by complete extirpation.

BONNEAU, RAYMOND. Diverticules du duodenum. *La Presse Medicale*, Sept. 26, 1923, lxxvii, 817–819.

The duodenal diverticulum is filled by causing the patient to lie on the right side and then to compress, with the right hand, the duodenojejunal angle against the spine.

Roentgenologically the diverticulum may be confounded with an ulcer of the duodenum or with a dilatation of the ampulla of Vater.

The connections with neighboring organs are most useful to know. There may be intimate relations with the bile ducts and with the pancreatic duct which find trouble in evacuation, and dilate. Sometimes they empty

into the diverticulum itself. In the pancreatic canals this goes on to fatty necrosis and hemorrhagic pancreatitis. Gall-stones may lodge in the diverticulum. Sometimes, the diverticulum penetrates into the mass of the pancreas from which it appears almost impossible to extract it surgically. Evacuation of the stomach is, under certain circumstances, difficult and retarded. The pancreatico-duodenal vessels, and those of the transverse mesocolic vessels eventually spread out on the surface of the diverticulum and form a groove. Thus one sees why a diverticulitis or peridiverticulitis may become serious. References are given to the literature on diverticula.

BLACKER, SIR G. The treatment of menorrhagia by radium. *Arch. Radiol. & Electrotb.*, July, 1923, xxviii, 47-55.

Radium can be used for the treatment of menorrhagia in the following conditions:

1. Cases associated with the menopause.
2. Cases due to presence of small fibromyomata in the uterus.
3. Cases in young women who present no signs of genital or pelvic disease.

All these can be safely and efficiently treated by the intrauterine application of radium.

The use of radium in fibromyomata should be strictly limited to small tumors, not larger than the uterus at the fifth month of pregnancy, not undergoing any form of degeneration, not complicated by any accompanying disease of the appendages and not projecting markedly into the interior of the uterus. Within these limitations radium gives good results. It is wise not to use it in submucous tumors since it is liable to cause sloughing and infection of the growth.

Radium should never be introduced into the uterus when there are signs of inflammation in any part of the genital tract.

It has been calculated that the uterus will stand a dose three times greater than that required to produce a skin reaction.

The author reports 68 cases, as follows: 34 for profuse hemorrhage at the menopause; 23 for hemorrhage with fibromyomata of the uterus, and 11 for menorrhagia without general or pelvic disease.

In the 34 cases of hemorrhage at the menopause complete amenorrhea has resulted—15 immediately after treatment, 11 after one period, and 7 after two or more periods.

In 23 cases complicated by fibromyomata complete amenorrhea followed the treatment in 16—10 without any further bleeding, 3 after one period, and 3 after two or more periods.

In the 11 cases treated for hemorrhages not due to general or pelvic disease, complete amenorrhea has resulted in 6, 2 have undergone hysterectomy, and in 3, hemorrhage has been controlled by the treatment.

The amenorrhea following the application of radium is no doubt due to its effect upon the ovaries and to the destruction of the Graafian follicles.

OCHSNER, A. J. The treatment of cancer of the jaw with the actual cautery. *J. Am. M. Ass.* Nov. 3, 1923, lxxxi, 1487–1490.

After describing the instruments, etc., and giving the reasons why removing a portion of a cancer for microscopic examination is not safe he says that there is, however, a safe method of obtaining a portion for microscopic examination, namely by use of the cautery knife.

During the discussion, Dr. Henry Schmitz of Chicago said: "Radium and roentgen-ray treatment in cancer of the jaws should never constitute the sole treatment, but be regarded an aid to surgery. Radium has a local intensive effect and therefore should be evenly distributed throughout the tumor mass and its periphery by the use of steel needles or emanation seeds. Roentgen rays are rather extremely diffused and therefore may be applied to large areas; for instance, the glands of the neck and sub-maxillary regions. The modern 200 kilovolt roentgen ray, heavily filtered, should not be used in jaw cancers, but preferably the 120 and 140 kilovolt roentgen ray, filtered with 0.25 or 0.5 mm. of copper. The latter method insures greater absorption of the rays which, of course, is essential for success. We should also avoid the destruction by rays of important secretory glands such as the parotid and the sub-maxillary. We should save at least one of each pair. If we do not do so, the patient will evince a wasting away leading to death, though the carcinoma may have been destroyed."

Dr. Gordon B. New, of Rochester, Minn. said: "In the sarcoma group, radium alone is about all that is necessary, while in the epithelioma group, thorough cauterization is the important thing. I believe that radium has done much to increase the mortality in cancer about the nose, throat and mouth, owing to the fact that it is being used in conditions in which it is not indicated, and used by persons without special training. Thickened leucoplacias and so-called precancerous conditions about the mouth are being treated with radium, which sometimes heals over the surface, and then the growth recurs as an active squamous-cell epithelioma. Radium is a very important adjunct in the treatment of malig-

nancies, but the selection of cases for its use alone and with surgery is very important."

Dr. Ochsner said in closing: "It is true that the incomplete operation increases the growth.

"I believe that Dr. Schmitz' insistence on the fact that the roentgen ray or radium must be used as an aid and not as a primary treatment should be borne in mind and emphasized thoroughly because as an aid it certainly has tremendous value.

"Dr. John Nuzum has been working for seven years with a filtrable micrococcus, which he finds in human cancer, which he can inoculate and which will produce cancer in mice and dogs in a certain number of cases. He is still at work, and will probably have to take a number of years before he can get all of the elements worked out."

JEHN. The significance of the roentgen ray in the development and diagnosis of thoracic surgery. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1923, xxxi, 6.

Thoracic surgery has been retarded in its development as much by the interpretation of clinical signs as from technical difficulties. Only since the roentgen rays have been employed in its diagnosis, and since pneumothorax can be avoided, has it developed more satisfactorily. One of the great advantages is that one can follow the case in its course by means of roentgenograms. Stereoscopic methods are especially adapted to thoracic work since this is a region where the cubic dimensions are of importance. Roentgen stereograms have greatly improved thoracic diagnosis, and have given suggestions for operative treatment, as well as for after-treatment. Great benefit has been experienced from the differential pressure method, and the roentgen ray has greatly perfected this method. Pathological anatomy can be studied with greater safety.

In surgical disease of the thoracic walls the importance of the rays has not been so great as in many other parts of the body, though it has been of assistance in the treatment and diagnosis of fractures of the bony thorax. They will show whether pleura and lungs are involved, whether the mediastinum has been injured, whether there are tumors in the walls, whether the tumors of the breast extend inward, etc. In osteomyelitis and tuberculosis of the bony thorax the fistulae are well recognized and the differentiation between tumor and gumma facilitated. Abscesses of the ribs or pleura may be located, and empyema delimited. The inter-relation between the walls and the organs of the thorax is clearly brought out.

In surgery of the pleurae and lungs not all complicated pathological conditions can be recognized with absolute safety, even by means of the roentgen ray. However, the combination of roentgenoscopy, roentgenography, and stereoscopy will show the function of the lung under normal and pathological conditions. Diseases of the serous membranes, of the parenchyma and bronchial system may be recognized with precision. The difficulty arises where large exudates and scar tissue dim the picture; and here are the limitations of the method. In pneumothorax the roentgen ray will help to follow the degree of filling, the resorption, and all the conditions of pressure within the thorax. Movements of the lung with closed pneumothorax will resemble the normal function as long as negative pressure exists. Paradoxical respiration, mediastinal flutter, etc,, can be clearly observed on the roentgen screen. Pressure pneumothorax may be shown very nicely in the serial pictures. It is generally caused by traumatism, or by purulent degeneration of an exudate, and gas formation. One will suddenly see a change in the mediastinum, a lowering of the diaphragm, and inspiratory dilatation of the thorax. If one punctures this pressure pneumothorax while looking at the screen, one can see how the pressure conditions in the pleural space are equalized. The mediastinal displacement disappears and danger of death is removed.

Total and partial exudates, epidiaphragmatic, mediastinal and apical empyema, especially the interlobular, have been recognized fully only since roentgen rays have been employed. It must be mentioned that even with this aid it is not always possible to differentiate between pulmonary abscess, tumors, and interlobular empyema. In these cases the pictures must be taken at various angles, and doing this, the interlobular spaces must be taken into account. Mediastinal empyema will often cause some difficulty on account of the broadening of the cardiac shadow. The exudate may propagate pulsation. Basal empyema may be differentiated from subphrenic abscess by the concave border towards the pulmonary apex. The subphrenic abscess has a convex border, providing there is not a simultaneous irritative exudate of the pleura. In the subphrenic abscess the movements of the diaphragm are impaired. In comparing the pictures, increase of exudate and the onset of resorption may be watched.

If an air bubble is seen above the exudate, one may conclude that attempts at puncture of the pleura have caused it, but it may occur in purulent exudates in the form of gas empyema, and may mean that an exudate has ruptured into the lung. Clinically, in the latter case, the patient who has a high temperature

and so far had no expectoration, will suddenly cough up great quantities of sputum.

If the lung does not expand after an operation there may be residual cavities, and the conversion of pulmonary tissue into connective tissue will be seen in the roentgenogram. The author does not employ contrast fillings because bismuth intoxication, emboli, and aspiration of the contrast media through bronchial fistula have been observed. Roentgenograms show the necessity of treating these residual cavities by means of Schedé plastic operations. The indications for the place and the extent of the removal of bone from the wall are given by the roentgenogram. It will show the operative results.

Direct and indirect bronchial fistula will be well shown. Chronic empyemata in most cases will clinically present the picture of tuberculosis, bronchiectasis, or pulmonary abscess, especially if they communicate with the bronchus. The roentgen ray will show, encapsuled in thick masses of connective tissue, extra-pulmonary pus foci with an air bubble. If this is absent, drying up of the exudate or calcareous degeneration may exist. These pictures very often resemble tumors. Hemo- and pneumo- and hemopneumothorax will show similar pictures to intrathoracic organic injuries, with the difference that the recent injuries will show no connective tissue complications. Mixed infections of tuberculous pleural exudates, which have been evacuated, and which have formed residual cavities, will yield the same roentgenogram as those existing after non-tuberculous empyema.

KUESTNER, HANS. Recurring questions on dosimetry. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1923, xxxi, 86.

Dosage involves the determination of a ray-mixture of definite hardness and intensity, applied for a definite time to a definite area of the body.

A standard dosimeter must be found, the sensitiveness of which is well known. It must be placed at a point which is affected by nothing in its surroundings. All apparatus must be standardized by it as to length of waves and other qualities. It has been found that the biological dose is an uncertain measure, and cannot serve as an entity, while the physical dose can be determined very exactly. Measuring of roentgen-ray energy has not been effected experimentally in a satisfactory manner. It is therefore advisable to use the sensibility of the standardizing apparatus as an entity. In this manner, the different dosages will be reduced to a standard measurement, and a comparison among them will become possible.

MAYO, CHARLES H., AND PEMBERTON, JOHN, J. Surgery of the thyroid and its mortality. *Ann. Surg.*, Aug., 1923, lxxviii, 145–149.

According to the dangers attending surgery, all lesions of the thyroid may be divided into two groups: goiters not associated with hyperthyroidism and goiters associated with hyperthyroidism. In those not associated with hyperthyroidism the dangers are those due to accidental causes to which any operation of equal magnitude are subject. In those associated with hyperthyroidism the greatest danger lies in the disease itself or the residual effects of the disease; thus operation may precipitate an acute exacerbation of hyperthyroidism from which the patient does not recover.

In the Mayo Clinic the incidence of postoperative obstructive dyspnea and pneumonia have been materially decreased since it has been appreciated that both are at least partially avoidable. The incidence of postoperative pulmonary infections has been reduced by avoidance of prolonged anesthesia and injury to the recurrent laryngeal nerve. In the last sixteen months, 819 thyroidectomies were performed on 819 patients, 3 of whom died, a mortality of 0.36 per cent.

The goiters associated with hyperthyroidism include exophthalmic goiter and adenoma with hyperthyroidism. The development of acute hyperthyroidism and the presence of visceral degenerative changes comprise the added dangers to surgery in both types, but as the relative dangers vary in the two types it is desirable to discuss them separately.

Exophthalmic Goiter. In recent years a larger proportion of cases is coming to surgery early in the course of the disease. This is illustrated by comparison of the data for different periods relative to the duration of the hyperthyroidism. In 1909 the average duration of hyperthyroidism was thirty-one months, in 1916 twenty-three months and for the first six months of 1922, nineteen months. This has reduced the mortality and improved the end-results.

The methods of combating postoperative hyperthyroidism, when it is once induced, are ineffectual. The mode of attack lies rather in prevention.

Preoperative preparation consists of medical and surgical measures. About 30 per cent on admission to the Clinic have a mild degree of hyperthyroidism, and, as the general health is unimpaired, routine preparation only is required.

Preliminary treatment of the hyperthyroidism is required in the other 70 per cent. By repeated basal metabolic estimations at intervals of every three or four days, the

progress of the disease may be accurately watched.

A comparison of the operative procedures employed in the first four months of 1923 with those of the same period for five preceding years is interesting. Primary thyroidectomy was performed in 56 per cent of patients in 1923, while the average for the preceding years was only 38 per cent. Twenty-four per cent had two or more ligations before thyroidectomy in 1923 and the average for the preceding five years was 37 per cent. Under the combined medical and surgical management, primary thyroidectomy has increased 18 per cent and the necessity for two or more ligations has been reduced 12 per cent.

Adenomatous Goiter with Hyperthyroidism. The added dangers here are due to the possibility of the development of acute hyperthyroidism and to the presence of visceral degenerative changes. Owing to the usual mild intensity of hyperthyroidism, the possibility of severe acute hyperthyroidism is of relatively small importance, while the presence of visceral degenerative changes is the most influential factor in the mortality rate.

During the past sixteen months, there were 277 patients with adenomata and hyperthyroidism operated on. Nine patients died, a mortality of 3. 24 per cent.

STEWART, M. J., AND LODGE, S. D. On unilateral fused kidney and allied renal malformations.

Brit. J. Surg., July, 1923, xi, 27.

1. The horseshoe kidney:
   (*a*) Fusion at upper poles.
   (*b*) Fusion at lower poles.
2. The concrescent kidney:
   (*a*) The prevertebral fused kidney.
   (*b*) The unilateral fused kidney.
   (*c*) The pelvic fused kidney.

In 6,500 autopsies there was found one example of unilateral fused kidney. Morris found "one fused kidney other than horseshoe-shape" in 15,908 autopsies.

The author found horseshoe kidney in 0.21 per cent of these cases; congenital absence of kidney in 0.24 per cent and pelvic kidney in 0.04 per cent.

In one case of pelvic kidney, the left kidney was absent and the right was situated in the pelvis. It was connected with the bladder by a short, kinked ureter only 3 in. in length, and obtained its blood supply by a single large vessel given off at the bifurcation of the aorta. Pelvic kidney may be in either the median or lateral position.

In the case of unilateral kidney, the ureters invariably opened in the normal location in the bladder. The most carefuly cystoscopy would therefore not reveal the facts, hence the value of pyelography. The adrenals may be in normal location in these cases.

There is a bibliography of nineteen references.

WHITAKER, LESTER R. Malignant lymphoma (Hodgkin's Disease) *Arch. Int. Med.*, Oct. 15, 1923, xxxii, 538.

This article is based on a study of 40 cases of Hodgkin's disease with seven necropsies.

Lymphosarcoma is the most frequent mediastinal growth, producing irregular growths with sharply defined outlines somewhat nodular in shape, extending far beyond the limits of the mediastinum.

In Hodgkin's disease the lungs may be infiltrated giving the impression of tuberculosis. These shadows are usually oval or elongated.

The shadows of the two diseases, lymphosarcoma and Hodgkin's disease, cannot be absolutely differentiated.

To best interpret the roentgenographic appearances of Hodgkin's disease it is necessary to have a clear picture of the gross pathology in mind as the plate is being examined.

The glands vary considerably in density because fibrosis in them is progressive; therefore, the shadows are less dense in early cases than in the older ones.

Two of the 7 cases that came to necropsy had lymphomatous infiltration of the lungs.

Seven out of the 40 cases had pleural effusions, 5 in the left, and 1 in both pleural cavities.

The intrathoracic involvement in Hodgkin's disease is divided by Wessler and Greene, into four groups: (1) Mediastinal tumor, extending to the lung; (2) infiltrative type—the borders of the infiltrating mass are indistinct and irregular. (3) Isolated nodules of metastases in the lung; (4) Discrete nodes at the roots of the lungs.

Twenty-two of the author's cases were of class 1; 11, of class 2; none in class 3; while 33 were of class 4.

Lymphosarcoma cannot be said to be essentially different from Hodgkin's disease. The roentgenographic shadows of carcinoma are more definite, with sharper outlines than those of lymphoma.

Tuberculosis and Hodgkin's disease are similar, both from a clinical and a pathologic point of view, resulting in many erroneous diagnoses and much disadvantage to the patients.

A rapid and marked reduction in size of lymphoma is demonstrable by roentgenograms after one or two treatments, and is regarded by some as almost diagnostic.

There is a biblography of fifteen articles.

MULLER, F. W. The roentgenological study of infectious arthritis. *U. States Nav. M. Bull.*, Oct., 1923, xix, 393.

The subject is divided as follows:

1. The use of a constant technique in making roentgenograms of joints will often eliminate errors in diagnosis.

2. There is need for a standard classification of the various forms of chronic arthritis.

3. Some authorities believe infection is the etiological factor in all forms of chronic arthritis. Up to this time this fact has not been satisfactorily proven.

4. There are certain roentgenological findings which enable the roentgenologist to differentiate to a fairly accurate degree the various forms of infectious arthritis.

In acute infectious arthritis there is no evidence in the roentgenogram beyond the swelling of the soft parts.

In chronic conditions there is evidence of joint destruction, increase of synovial fluid, and cartilage change.

In pyogenic arthritis, at an early stage, there is swelling of the soft tissues and effusion into the joint; rarefaction may occur as a result of fixation or neighboring inflammation. The joint space is narrowed, depending upon the amount of destruction of cartilage.

In gonorrheal arthritis, except in the knee-joint, there are no characteristic roentgen appearances. In the knee there are two characteristic findings. First, thinning of the cartilage between the patella and femoral condyles, displacing the patella backward into the intercondylar space. To demonstrate this a lateral view is required. Second, small localized areas of rarefaction may be present, due to necrosis of the subcartilaginous bone at the lateral margins of the joint surfaces of the femur and tibia. This condition is best shown in anteroposterior views. Bony spines along the attachments of tendons are usually due to gonorrheal infections.

Tuberculous arthritis is characterized by soft tissue swelling, effusion in the capsule, and general blurring of the joint outlines, giving the appearance of a picture of poor quality. The bones outside the affected joint show normal detail and density, and in young people the epiphyses are enlarged and squared, from synovial irritation.

In the spine the process attacks the intervertebral disks and adjacent margins of the vertebral bodies with more or less destruction and collapse of the bodies.

In tuberculous arthritis of the spine there is angulation, with, usually, posterior deformity, obliteration of the joint space and body involvement. There is no bone production unless there is a mixed infection.

In non-tuberculous cases there is no angulation, no obliteration of the joint spaces and no body involvement, but there is bone production.

Coccidioidal granuloma may closely resemble the picture of tuberculous infection.

Luetic arthritis is characterized by marked periarticular swelling, thickening of the synovial membrane, fluid in the joint and a small area of periostitis.

The report of the roentgenologist should include all the roentgen-ray evidence, avoiding the use of technical roentgenology, in order that the clinician may correlate the roentgen-ray signs with the clinical evidence.

There is a bibliography of twenty-three references.

LABEAU, ROGER, AND BERTRAND, MARCEL. Uterus fifteen months after curietherapy for cancer of the neck. Destruction of the cancer. (Uterus 15 mois après curiethérapie pour cancer du col. Stérilization du cancer.) *Gaz. bebd. d. sc. méd. de Bordeaux.* Sept. 9, 1923, i, 435.

The specimen was presented which had been removed to gain access to a tumor of the sigmoid loop in the lower part. This had been subjected to curietherapy fifteen months previously.

The specimen was small and normal in form, even the neck which had been the seat of the cancer. On section it appeared healthy, but fibrous. The cervical canal appeared to be closed through a distance of 1 cm., and on transverse section of the neck no opening was apparent.

The radium application had consisted of 150 mgm. of bromide of radium in four tubes; two intrauterine tubes in tandem; two others in the lateral cul-de-sac of the vagina; filtered by 0.4 mm. of platinum, 2 mm. of gold, 2 mm. of caoutchouc; duration, seventy-two hours. The woman was fifty-seven years of age and the cancer was located on the anterior lip and cervical canal (épithélioma tubulé).

The prominent histological finding is the sclerosis which transformed this organ into a fibrous block in which the muscular bundles are replaced by connective tissue.

EISENDRATH, DANIEL N. Hypernephroma of the left kidney. Value of pyelography in early diagnosis of renal neoplasms. *Surg. Clin. N. Amer.*, Aug., 1923, iii, 1007.

The special technique used in the removal of the tumor mass was the ligation of the renal pedicle first before beginning the mobilization

of the tumor itself, in order to prevent the propulsion of a possible tumor thrombus into the vena cava and from here into the general circulation.

A second ligation was so placed as to prevent the escape into the wound of particles of a possible extension of the tumor into the vein.

In the absence of hematuria and of palpable enlargement of the kidney, the only symptom which led to a suspicion of some lesion of the upper urinary tract was the presence of pain in the left upper quadrant of the abdomen and over the iliocostal space. The diagnosis was based exclusively upon the presence of a filling defect in the pyelogram which we have learned to interpret as due to the invasion of the renal pelvis by a tumor.

The author divides these tumors into those of the parenchyma and those of the renal pelvis.

In hypernephromata a metastasis is often discovered months or even years before there are localizing symptoms referable to the kidney.

Reflex Ileus. One may encounter cases in which the predominating symptoms are those of acute ileus. This may be due to a massive hemorrhage into a tumor or the passage of clots from the kidney to the bladder. It is purely a reflex condition and due to the intimate relation of the renal and intestinal innervation.

Pyelography is a method of great value, showing filling defects, distortion of the outline of the calyces, and the presence of hydronephrosis.

The veins were involved thirteen times in 86 cases reported by Block and four times in 19 cases reported by Wright. Hence, the first consideration is to prevent transmission into general circulation of a tumor thrombus.

Rehu in one case resected a portion of the vena cava itself, with tumor thrombus.

BERTWISTLE, A. P. A depressed fracture over the angular gyrus: clinical and radiological localization. *Brit. J. Surg.*, July, 1923, xi, 73.

The following method was devised to locate intracranial structures upon the skull:

A skull was divided sagittally with the corresponding half of the brain. Between the more important gyri were implanted pieces of copper wire moulded according to the shape of the sulci. The boundaries of the parietal bone were marked by a thin wire glued on its margin. The brain was placed in the skull and roentgenographed lying on its mesial surface, so that the picture was a true lateral one. It was noticed that horizontal sulci lie nearer the vertex than is shown in the text books. The vertical ones show an apparent decrease in length due to the convexity of the brain. This key is useful in reading roentgenograms of skulls.

It is necessary that the patient's skull should be in the same position as the key, truly lateral. This can be accomplished by placing a small lead bead in each external auditory meatus and bringing these shadows together. The base line on the skull and the key measure 8.6 and 9.1 respectively, so that all horizontal distances before translation from the skull to the key must be multiplied by $\frac{9.1}{8.6}$.

He then applies his rule to the case reported and thus locates the skull injury over the angular gyrus.

He concludes that by the use of base lines from the inion to nasion, and a constant, it is possible to localize, in roentgenograms, the area of brain involved in injuries of the skull, even though the case be that of an infant.

JOLL, CECIL A. Metastatic tumors of bone. *Brit. J. Surg.*, July, 1923, xi, 38.

The object of this paper is to show that a knowledge of bone metastases, their mode of production, the types of neoplasms which give rise to them, and their special clinical manifestations is essential.

Secondary tumors in bones arise: (1) By direct extension from tissue outside of bone into its substance (not metastasis); (2) by malignant emboli through the blood stream; (3) by extension through lymphatic paths. This third method requires a knowledge of the lymphatics of periosteum, bone and bone marrow.

The author believes that bone metastases are blood borne. He also makes the statement that squamous carcinoma has a tendency to produce secondary deposits in bone, which is not generally appreciated.

He then gives numerous cases with illustrations, and a bibliography of ninety-two references.

FRIEDMAN, J. C., AND STRAUSS, SIDNEY. Observations on changes in the size and shape of hearts during the progress of compensation. *Arch. Int. Med.*, Oct. 15, 1923, xxxii, 601.

The lack of exact measurement in past studies on variations in the size of the heart is the reason for this study.

The heart in decompensated chronic lesions was first percussed. The borders so located marked with lead markers and teleorentgenograms made so that percussion errors might be visualized and more exact data be obtained. Two main points were determined: First, the so-called transverse diameter of the heart; and, second, the heart outline. It seems to be established that this diameter taken in con-

junction with the heart outlines furnishes the most reliable evidence of change in heart size.

Twenty-one cases of chronic endocarditis and myocarditis were observed; 11 of these had mitral disease; 1, aortic insufficiency, and 9, myocarditis. These cases were divided into three groups:

(*a*) Those leaving the hospital unimproved, whose heart outlines remained unchanged.

(*b*) Those leaving the hospital with hearts more or less compensated, and with heart outlines unchanged.

(*c*) Those leaving the hospital improved and with heart outlines changed.

The technique used to obtain a composite plate was to superimpose plates, using two fixed points, such as the junction of the transverse processes with the tubercle of the first rib.

The arch of the aorta and the lateral chest walls also served as checks in superimposing plates. In this manner heart outlines of any number of films may be drawn on a single one for comparison.

One conclusion is that cardiac compensation may be restored without any change in any diameter of the heart, with changes only in the great vessels, especially in the superior vena cava and pulmonary artery.

A total change of 1 cm. in the transverse diameter is within the limits of roentgen-ray error. A change of less than 1 cm., when accompanied by change of shape, may have considerable significance.

The most frequent change is that of the base, namely, the superior vena cava and pulmonary artery. This variation cannot usually be determined by percussion. Decompensation occurring more than once may be due to affection of different parts of the heart, although the clinical symptoms are the same.

In chronic heart disease there may be marked variation in function, with slight or no variation in size.

KINGSTON, JOHN J. Notes on the *x*-ray treatment of whooping-cough. *Calif. State J. M.*, Oct., 1923, xxi, 429.

This is the history of 24 selected cases of whooping-cough, in children from seven months to thirteen years of age.

They were given from one to three exposures, at weekly intervals, of one-fourth the erythema dose—20 ma. min., target skin distance 12 in., 9¾ in. spark-gap, ¼ mm. cu. filter—over large areas of the chest, both front and back. The duration of the disease was from three days to one month when treatment was instituted.

In the whole group before treatment there were from 445 to 489 paroxysms daily; after one treatment there were from 218 to 245, or 49 to 50 per cent of the previous figures; after two treatments, 65 to 74, or 15 per cent of the original figures; and after three treatments, 9 to 10, or about 2 per cent of the original figures.

Whooping ceased in 5 cases after one treatment; in 5 cases, after two treatments; in 7 cases, after three treatments; and in 1 case after four treatments.

The definite improvement secured in many patients and the prompt and almost complete relief in a few, constitute a positive gain in treatment.

A short history of the 24 cases then follows.

SOILAND, ALBERT. The therapeutic aspect of short-wave *x*-rays. *Calif. State J. M.*, Oct., 1923, xxi, 415.

New dangers have appeared with the short wave-length of the high voltage roentgen ray. These disturbances are nausea, prostration, a changed blood picture and inflammatory, ulcerative and fibrous tissue changes in the intestine.

The blood changes and anemia are due to a deleterious biologic action on the lymphocytes, which are very susceptible. The red cells are more resistant.

The author has used deep roentgen therapy for a little over a year and feels that the time has been too short to classify the results with precision.

Reference is made to a bill allowing laymen to use this very powerful weapon in the treatment of the sick. The bill passed the legislature of the State of California, but the governor withheld his signature, due to the protests of the medical profession of the state and others, and thereby nullified the act.

MORISON, J. M. WOODBURN. Elevation of the diaphragm. Unilateral phrenic paralysis. A radiological study, with special reference to the differential diagnosis. *Arch. Radiol. & Electrotb.*, Aug., 1923, xxviii, 72; Sept., 1923, xxviii, 111.

Unilateral phrenic paralysis is not uncommon. The author has seen 9 cases in the last two years; diagnosis confirmed post-mortem twice.

In 2 cases the right phrenic was involved, and in 7, the left. Three cases occurred in secondary carcinoma of the mediastinum (1 secondary to carcinoma of the stomach, and 2 to carcinoma of the breast); 3 with tuberculosis; 2 with growth in the chest; and 1 with aneurism of the aorta.

Paralysis of the left phrenic nerve, due to a pathological lesion, presents roentgenologically the same characteristic features as Petit's eventration. It is only a question of variation in degree.

In adults the position of the central tendon is about the level of the eleventh dorsal vertebra. The right dome rises to the lower border of the fifth rib, and the left to the upper border of the sixth rib.

At birth the central tendon is on a level with the eighth or ninth vertebra. Normally the movements of the two leaflets are synchronous.

The stomach can be seen, during roentgen examination, to alter in shape with the act of respiration. During inspiration it becomes shorter and broader, the lower part of the curvature not altering its position.

The movements of the paralyzed diaphragm are reversed and the author thinks that this paradoxical respiratory movement is the cardinal feature.

In children a temporary elevation of the diaphragm is not uncommon. In temporary elevation the movements of the affected leaflet are not reversed. They are always synchronous with each other and with the other half of the diaphragm. In other words, there is no paralysis.

Examination of the stomach with the bismuth meal should rarely fail to settle the diagnosis.

Among his conclusions the author states that the diagnosis from the roentgenological standpoint rests on:

(*a*) The unbroken bowline extending high up into the thorax with its reversed movements, unless adhesions have formed.

(*b*) Free fluid level at the cardiac orifice.

(*c*) Bismuth meal examination.

There is a bibliography of thirty-five references.

NAGLE, GUNTHER W. The etiology and importance of the cystico-duodeno-colic fold. *Surg., Gynec. & Obst.*, Sept., 1923, xxxvii, 365.

This is the occasional fold found extending from the fundus of the gall-bladder to the duodenum and transverse colon.

The folds which the author found are prolongations of the lesser omentum onto the under surface of the gall-bladder, extending to the right, across the duodenum and downward to the transverse colon where they become continuous with the anterior layer of the greater omentum.

He concludes that this ligament is a part of the lesser omentum and therefore of congenital origin. It is a source of danger in that it represents a potential adhesion, ready to thicken and shorten in response to neighboring pathological processes, and to furnish a guide and stimulus to the formation of true adhesions.

PALMIERI, G. G. Latest studies on the diffusion of *x*-rays and their application to deep roentgen therapy. *Radiol. med.*, 1923, x, 313.

The aims, beyond many others, in roentgenotherapy are (1) to apply the largest possible dose to the diseased part, which is more or less deeply seated, while preserving the integrity of the surrounding healthy tissue; (2) to reduce the time of ray application. No technique can render the deep dose smaller than that touching the skin which covers the radiated area. Modification depends on dispersion, absorption and diffusion. The last factor may help to diminish and improve the deep dose. The German roentgenologists, at the present time, use the distant field to improve the quotient of the diminished dose with the effect of dispersion. But in many instances this lengthens the time of radiation considerably (ten to fifteen, or even twenty hours).

The author has constructed an apparatus which will allow short exposures for the superficial tumors and indirect radiation of the deep-seated lesions.

Many attempts have been made with paraffin, water contained in rubber bags, horse flesh, etc., to employ a covering which would be comparable to the tissues, or, with paper boxes filled with bolus alba, to obtain homogeneous distribution of the roentgen energy. The experiments have shown the rays to be less effective than the computations made regarding them would indicate. When the author used a stratum of water of 5 to 10 cm. the ionization chamber indicated a marked diminution in comparing the rays above and below the water, and a marked improvement when the paraffin filter was applied at some distance from the surface, but this improvement was experienced only up to a certain point. The optimum distance from the skin for the paraffin was 5 to 10 cm. To shorten the time of exposure a collector on the principle of the Chaoul collector was added. In it the primary bundles are surrounded by paraffin.

BERTOLOTTI, M. Radiologic study of the act of deglutition of an encapsulated bolus. *Radiol. med.*, 1923, x, 361.

The deglutition of fluids in the esophagus follows strictly the laws of gravitation, and is mechanical. The muscular contractions of the bucco-pharyngeal tract cause a siphon action.

These studies were made in the erect right anterior oblique plane. The constrictors carry the bolus to a point where the elevators of the pharynx send it to the esophageal opening.

If the mouth of the esophagus fails to aspirate it, it may be rejected to the summit of the buccopharyngeal canal, by means of a reflex contraction of the striated muscles of the hypopharynx, not by an antiperistaltic wave. When pultaceous bolus, for instance, barium bolus, is given, no decided stop can be demonstrated; there is only an elongation of the swallowed mass; while an encapsulated bolus will make a decided epicardial stop. It passes slowly for about 4 to 5 cm., and then is suddenly projected into the air-space of the stomach. This suggests a cardial canal. It starts 2 to 3 cm. above the phrenic ring, and exends for another 3 to 4 cm. through the entire diaphragm, along the pillars formed by the anastomosing fibers of the phreno-esophageal musculature. There is, at the extreme lower end of the esophagus, an epicardial tract, 5 to 6 cm. long; by its almost entire closure it contrasts with the parts above it.

From his observations the author finds an epicardial stop, and an epicardial phase of deglutition, and a segmentary peristaltic wave in the esophageal cavity. A motor insufficiency in the esophagus is probable, and may be due to some change in the equilibrium of the mediastinal nerves.

Howze, Charles P., and Hennessey, Russel A. Urethral diverticula. *Surg., Gynec. & Obst.*, Sept., 1923, xxxvii, 392.

This paper accounts for a total of 80 cases, including those of the authors, and gives the division made by Watts:

A. Congenital
B. Acquired
1. From dilation of the urethra due to—
(*a*) Calculus
(*b*) Stricture
2. With perforation of the urethra, resulting from—
(*a*) Injuries to the urethra
(*b*) Rupture of abscesses into the urethra
(*c*) Rupture of cysts into the urethra

There is a further division of true, with lining of mucous membrane, and false, without it.

The authors report Bumpus as saying that the diverticula of the posterior urethra are probably always of the acquired type.

They report a case with a stone in the bladder and one in the diverticula of the posterior urethra.

Piergrossi, L. For a more rational method in dosing in roentgentherapy. *Radiol. med.*, 1923, x, 279.

An apparatus which is to give satisfactory results as to exactitude and rapid reading must fulfill the following requirements: Independently from the type of apparatus and tube, it is necessary to state in a constant manner the shortest wave-length contained in the bundle of rays must be indicated with the notation λ min. It must indicate the time necessary to obtain the skin dose, which cannot be surpassed, without reaching the erythema dose—the relative deep dose, obtainable by a definite distance, filtration, and a definite field of radiation.

Simple and practical roentgenologic dosimetry must be based on (1) direct measurement of the wave-length, by means of the spectrometer, and (2) the measurement of the relative deep dose, which depends on the λ min., the type of filter, the surface of the radiated field, and the focus-skin distance. They may be measured by the ionometer (iontoquantimeter), or more simply, with the brom chart, which is described, and is similar to Kienboeck's bromo strips. Pure wax blocks are used to determine the strength of the dose. The Sabouraud Noiré paste is used in determining how high a dose the skin will tolerate. After establishing the λ min. the relative deep or superficial doses are determined.

Pirazzoli, A. The "oculo-esophageal" reflex in tumors of the esophagus. *Radiol. med.*, 1923, x, 415.

In the July, 1921, number of the same journal the author had published the observation of an oculo-esophageal reflex in a number of patients who were suffering from esophageal dilatation, the so-called idiopathic distention, or from cardiospasm, where the thickening of the mucous membranes and the elastic fibers still permit of a vagus reaction. Pressure upon the eye-ball called forth the reflex. The present studies made on 5 patients with neoplastic formations in the esophagus showed that the reflex is not found in this type of disease, and this absence is recommended as a diagnostic aid in differentiating between spasm and neoplasm.

Rocchi, G. Roentgen apparatus with continous secondary tension. *Radiol. med.*, 1923, x, 289.

A transformer of high tension with an alternating current is described, with two batteries of condensors, in which the feeding circuits are inserted in opposite directions, four thermoionic valves, placed in a manner to supply the two condensor batteries always with current of the same polarity. The two accumulator batteries are arranged in series, and introduced into the circuit of a Coolidge tube, with a tension double that of the feeding tension. If the transformer has 125,000 volts that in the tube has 250,000 volts, so that the current becomes continuous and practically

constant. The milliamperage in the above named tension in a normal apparatus may amount to 10 ma., so that four tubes can be supplied simultaneously with about 2.5 ma. each. A self inductor is placed in the series of the first transformer, and the tension is regulated by the variations of value in it.

PODESTÁ, V. The radiologic picture of the cerebral ventricles injected with gas, and its diagnostic value. *Radiol. med.*, 1923, x, 371.

According to the publications of Dandy and Bingel pneumoventriculography has been used in a vast number of cases, especially in Germany, where reports were made at the Congress of Surgeons, at Berlin, in 1922, at the Neuropathologic Congress, at Halle, and the German Naturalists' Congress at Leipzig.

The spinal route and oxygen were given the preference. Its diagnostic value has been advocated in cerebral tumors, in hydrocephalus, for the differentiation between cerebral and cerebellar tumors, and to show up lesions in the cerebral cortex. Much experience is necessary to use this diagnostic aid intelligently.

Failure in making a pneumoventriculography is generally interpreted as a sign of existing closure between the subarachnoid space and the ventricles.

In Italy, Grotan, of Trieste, was the first to report 2 cases, with autopsy control. In 1 a tumor existed at the base of the cranium, at the point of origin of the dura mater. The frontal lobes were involved. The right lateral ventricle was shown to be compressed by the tumor. The second case was that of tuberculous meningitis with multiple tubercles in the cerebellum. The failure to inject gas was probably due to the rigidity of the ventricular walls.

At the second reunion of the Ligurian Radiologists, in May, this year, Bertolotti reported ependymal meningitis in a lateral ventricle. The roentgenogram had shown the difference in size of the two ventricles. Erroneously this was attributed to a tumor of the pons. Generally the method is considered without danger; 5 cases of death have been reported. In 1 of these instances the gas was introduced directly into the ventricle.

In almost all cases vomiting, headache (usually frontal) weak pulse, vertigo, and pallor were experienced. The method is contraindicated in alcoholism and arteriosclerosis. The gas is generally expelled within six to ten hours, but the ventricle often remains dilated for two or three weeks.

As a therapeutic measure it has been used in hemicrania and epilepsy. The former was not improved, but in epilepsy some improvement was seen. In 1 of these cases the fits ceased for a period of five months.

NICOLIS, S. Study on the humerus varus. *Radiol. med.*, 1923, x, 277.

In the last fifteen years Bircher, Angeletti, and Merlini have studied the direction of the upper portion of the humerus. The direction of the epiphysis in relation to the diaphysis is governed by the measurements of two angles, one which the axis of the epiphysis forms with the axis of the diaphysis (axis of inclination), and an angle which is formed by a line passing through the base of the femoral head in the lower, and of the humerus in the upper, with the axis of the diaphysis (angle of direction).

In a normal humerus the inclination angle is about 135° and the direction angle about 45°. When the direction of the humeral epiphysis tends to drop with relation to the diaphysis, a state like that in coxa vara is found. The angles of inclination and of direction diminish. This state was found by Bircher in cretinism, and by Merlini in achondroplasia.

The author examined a patient who was somatically and mentally under-developed, for a tumor of the humerus which was suspected to be a secondary formation of a thyroid tumor. The roentgenogram showed the angle of inclination reduced to 120° and the angle of direction to 36°. The upper margin of the greater tuberosity reached beyond the transverse line which passed through the superior border of the head of the humerus. The head of the humerus did not show the regular spherical formation, but was flattened above, and bulged below. The varus formation is not limited to the head, but extends to the meta-epiphysis.

SARACENI, F. Balancing or pendulant movements through the sphincters. *Radiol. med.*, 1923, x, 233.

The author had occasion to observe spontaneous pendulant movement in the pyloroduodenal region of 3 patients. In the first of these cases he could observe an insufficiency of the ileocecal valve in consequence of these movements, which were more alternating than balancing. The 2 other patients presented pendulant movements in the stomach and duodenum. In these 2 cases the pendulant and balancing motion was quite pronounced. It is evident that in this portion of the gastrointestinal tract the motion would be visible and lasting. It is not the same in the ileocecal portion where the ordinary movement is less energetic and not as rhythmic as in the stomach. There are no peristaltic and antiperistaltic waves which follow in regular series or

groups, but small peristaltic haustral and larger long waves with rapid sequence. The pendulant motion in this section of the intestine greatly varies in character, large and powerful waves following rapid small displacements.

The most interesting feature of the observation was the participation of two different cavities, which had different, even antagonistic functions, in this pendulant flow.

The insufficiency of the sphincter was quite explicable on the ground of the existing cirrhotic cancerous hardening. In a patient with duodenal ulcer the insufficiency was functional rather than mechanical.

SARACENI, F. A special case of pes varus equinus. *Radiol. med.*, 1923, x, 324.

The observations made on a child seven years of age led to the conclusions that: The participation of the head of the fibula in the function of the knee is not a pathognomonic sign of achondroplasia, which certain authors have stipulated. Tibialization of the fibula takes place, for the fibula fully substitutes the function of the tibia. An inferior tibiofibular diastasis makes possible and facilitates this reversion of function. The increase in the various segments of a joint, just as in any other part of the body, is the greater and the more marked according to the development and importance of the part.

The body weight, in pes varus, is to the greater extent, transmitted to the base of the fibula. The fibula in the case reported was much longer than the tibia. The upper epiphysis is larger than on the other side. It is cone-shaped, and turns somewhat toward the median line. In its upper pole it is about on the level with the superior epiphysis of the tibia. The density of the fibula is much greater on the deformed side, expecially at its base. The tibia, in its upper two thirds, is not vertical in direction, but oblique, being directed inward at the base. This is compensated by an external convex curve in the middle third.

MUEHLMANN. On stimulating radiation. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1923, xxxi, 71.

The author used the so-called irritative doses ("Reizdose") on the thymus in psoriasis of all types and ages, but without good results. The spleen was treated in the same manner in a case of morbus maculosus, which had been absolutely uninfluenced by clinical treatment. After giving roentgen treatment the patient was perfectly healed, and has remained well for two years. If severe secondary and genuine pernicious anemia have not passed the possibility of reaction, the general condition is very favorably influenced by the stimulating dose. If hemoglobin was reduced too far, for instance to 10 per cent, no results were expected. Even cases that did not react to blood transfusion and arsenic in high doses were benefited.

The results in acute inflammation of the kidney with typical retention of urine were excellent. Two cases are reported which show the efficacy of this method. Clinical measures had failed in severe anemia and in reflex anuria where one kidney had been removed. In nephrosis results were good.

PICCALUGA, N. On cure of hemorrhoids by radiotherapy. *Radiol. med.*, 1923, x, 419.

Hemorrhoids are inflammatory processes in the vessel walls. The vessels are dilated and infection takes place. The desired effect of treatment—except that of surgery—is the decrease of inflammation, sclerosing of the tissues, and resorption of the changed parts. Cicatrization is desired.

For roentgenotherapy these patients are placed on the table with knees flexed upon the thorax. The anal region is exposed as much as possible and washed with benzene and ether. Metallic iontophoresis is employed. A 1 cm. layer is used to delimitate the field of about 4 by 6, or 6 by 8, according to the extent of the hemorrhoids. The cotton is moistened with a one-half per mille solution of succinimid of mercury. Over the cotton a strip of tin foil is placed which unites the positive poles. The negative pole is, as usual, leaden, and the cotton placed on it is moistened with water and applied to the sacral region. A current of 30.46 volts, 10 to 15 ma. is used which the patients tolerate very well. During the last minutes of the iontophoresis, radiation is applied with a filter of ½ mm. Zn; 3 mm. Al., 200 kv., 2 ma., at a distance of 30 cm. The irradiation is made with 40 to 60 per cent of the erythema dose. The treatment is repeated two or three times, with intermissions of about fifteen to twenty days, and the dose is reduced to 20 per cent.

Seventeen cases treated in this manner, with good results, are reported. The only complication to be guarded against seems to be the undue absorption of mercury, which may cause renal lesions.

MILANI, E. The functioning of the small intestine (jejunum) studied in a seriograph. *Radiol. med.*, 1923, x, 409.

The movements of the intestines were studied in 1872, on the open abdomen of animals bathed in physiological saline solution, at a temperature of 38°C. The peristaltic, pendulant and (by Braam-Houckgest) the rotatory

movements were described. The duodenum, jejunum and the ileum differ in a physiological sense. If the small intestine measures 6 to 8 mm., its caliber varies from 3.3 to 1.5 cm. There are longitudinal and circular muscle fibers, and in its entire extent the circular valves of Kerkring stud the mucous lining.

In the roentgenograms the author has found an appreciable difference between the distribution of the loops of the jejunum and those of the ileum. The mesenteric bands have some influence on the loop formation. The jejunal peristalsis is very lively and continuous, while that of the ileum is intermittent, with long intermissions between the peristaltic actions. The jejunal loops which follow the mesenteric attachment to the left are more active than the last loops. The transporting peristalsis in the jejunum is typically precipitate. The simultaneous sudden filling of the first jejunal loop and the large curvature of the stomach are often seen in gastro-roentgenography. The movement of kneeding and mixing is characteristic of the jejunum. The rapid motion of the loops causes an appearance similar to that of a fir tree covered with snow. The contents of the loops is divided and subdivided many times. During the mixing and kneeding peristalsis a pendular motion is seen, and beside it there are small superficial movements. Between the peristaltic phases the Kerkring valves are clearly seen.

MATONI, H. H. Deep roentgen radiation of gastric and duodenal ulcers, and its success. *Med. Klin.*, Sept. 9, 1923, xix, 1220.

Deep roentgen rays were long dreaded by physicians, in the treatment of the stomach. They are, however, of great value. The author used them in gastric ulcers, watching the results for two and one-half years. The cures were clinical, all discomfort disappearing. The anatomical result has not yet been demonstrated because all the patients are still living. The diagnosis of gastric or duodenal ulcers must be established beyond doubt by roentgen examination. All gastric ulcers without stenosis, either simple or penetrating can be treated. The callous ulcers must be excepted. All duodenal ulcers, without stenosis, parapyloric conditions and pylorospasm, can be treated.

The dose given is 60 per cent of a cutaneous erythema dose, applied to the diseased area.

Complete clinical recovery was effected in 108 out of 140 (77 per cent); 19 (13.6 per cent) were much improved; complete failure was registered in 13 (9.3 per cent). Some influence, which is lasting, is always noticed on the acid secretion. Generally analgesic action soon follows radiation. Profuse hemorrhage is quickly subdued by it, and occult hemorrhage soon stops.

ALTSCHUL, W., AND SPITZ, A. Roentgenologic and clinical studies on primary tuberculosis. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1923, xxxi, *Kongressheft*, 22.

Exogenous infection with tuberculosis of an organism previously intact will cause the so-called primary complex; that is, a primary focus will form in some section of the lung and the surrounding lymphatic glands will be involved. From this primary focus, a chain of caseous miliary tubercles will develop in the descending lymphatic vessels. This process was often seen isolated and without involvement of the apices. These isolated caseous and calcareous foci are often found in children. Assmann has found them particularly in the the lower parts. The authors succeeded in a number of cases in demonstrating some old calcareous foci on the roentgen plate. Often, if they are not extensive, they are not easily shown up. Sometimes they are covered by the ribs and will appear in the intercostal spaces only during respiration. When the roentgen ray is employed directly one can, with some care, find them on the screen. Generally it is easier to find the lymphatic nodes than the primary focus. Normal lymphatic gland cannot be demonstrated by the roentgen ray and will, at most, produce only enforcement of the shadow formation. Those glands situated at the angle of bifurcation cannot be demonstrated with straight rays. The hilus glands on the left side are seen distinctly only when they extend laterally from the cardiac shadow, but when the patient is turned somewhat to the right, smaller ones may be seen if they are viewed in a sagittal direction, at the side of the cardiac shadow. Paratracheal glands, if sufficiently large and dense, can be distinguished. Caseous glands show up distinctly in their lighter surroundings. They will show up on account of their contents of acid calcium phosphate. The most intense shadows are due to calcareous glands. The paratracheal glands were sometimes found to be located laterally from the primary focus, and sometimes on the opposite side. The tuberculous process may extend from the primary focus down the same side, along the lymphatics as far as the venous angle, or it may cross the middle and reach the venous angle of the opposite side. By comparing the clinical and roentgenological findings one will arrive at a correct diagnosis. In the acute inflammatory stage of the primary complex the roentgen examination does not yield the same reliable results. In only rare instances

will the primary focus be located clinically, and only the subsequent involvement of regionary lymphatic glands will produce distinct symptoms. Clinically, as well as roentgenologically, the bronchopulmonary glands are the most easily accessible. Active hilus glandular tuberculosis is clinically well defined. After the tuberculous process has taken its course and the glands atrophy, the primary complex is clinically no longer demonstrable. At this time the roentgen ray will show up the remnants very well.

KNAPP, ARNOLD. Orbital changes produced by radium in cancer of the upper jaw. *J. Am. M. Ass.*, 1923, lxxxi, 1849.

As a result of radium application, definite changes may occur in the orbit and affect the eyeball. These changes, aside from deleterious action on the eyeball, suggest extension of the malignant growth. The question then arises whether the orbit should be exenterated or not.

It is, therefore, necessary to study the condition in the orbit which radium produces when applied in the treatment of tumors of the upper jaw and to compare this with the involvement of the orbit in the course of tumors of the upper jaw.

A study was made of the histories of tumors of the superior maxilla which had occurred in the General Memorial Hospital, in New York. In the terminal stages of the disease it is difficult to say when the involvement of the orbit begins. It is infrequent in the early stages and then begins through the inner or nasal wall or posteriorly through the floor. Inflammatory symptoms are absent, and the ocular muscle paralyses are not marked.

When radium has been applied the swelling anteriorly is different from the usual tumor growth and presents definite inflammatory symptoms, such as an involvement of the ocular muscles and especially of the inferior rectus, congestion of the eyeball, detachment of the retina, panophthalmitis, and destruction of the eyeball.

When radium is applied near bone tissue, which is so easily devitalized, necrosis results and infection follows. The effect of the gamma rays are long deferred, for weeks and even for months.

It is necessary to use the caustic effects of radium in these cases, as the results of radium and surgery combined are definitely better than surgery alone; yet, the possible deleterious action of radium on the orbit must not be overlooked.

MARSHALL, JOHN A. Changes in tooth structure resulting from deficient diets. *J. Am. M. Ass.*, 1923, lxxxi, 1665.

Nine puppies, born Sept. 10, 1923, were segregated and fed a restricted diet from Sept. 25 until they were killed in May and June.

The deciduous teeth, apparently normal in size and shape, were not shed in the usual manner. The permanent incisors, cuspids and molars of the mandible were more generally affected than those of the maxilla.

In Dog 7, the lower permanent incisors were malposed and presented the appearance of arrested growth, so that the position in the arch, as well as contour and size of the teeth, was influenced.

In Dog 8, the bones have undergone marked degenerative changes. They can easily be cut with a pocket knife. Nearly all of the teeth have lost their attachment to the peridental membrane, and are very loose.

The surfaces of the teeth are rough in some cases, as though they had been placed in acid. In nearly all of the animals, some abnormality is evident.

It was found in many cases that the dentin had undergone noteworthy changes. Underneath the enamel cap was a mass closely resembling pulp, but there was no dentin between the enamel and this fibrous area. The soft tissue beneath the normal enamel was more firm than pulp tissue and was highly vascular. On section, the identification of both the inorganic and the organic portions of the dentin was impossible. Neither the dentin tubules nor tubular contents remained. Even the organic matrix, which is very characteristic in the decalcified section, had undergone profound changes.

If, by relatively simple diet experiments, such profound changes can be wrought in a short space of time, how much more significant becomes the study of the influence of diet on the growth cycle of the organism.

The dental lesions noted are: First, "caries-like" defects; second, loss of the attaching tissues of the teeth, or of the teeth themselves; third, fracture of teeth, and, finally, pulp exposure and the production of osteodentin.

HART, W. E. Phytobezoars. *J. Am. M. Ass.*, 1923, lxxxi, 1923.

There are four varieties found in the human being:

1. The trichobezoar, or hair ball.
2. The trichophytobezoar, consisting largely of hair and vegetable matter balls.
3. The shellac concretion is found in those who use shellac varnish as an intoxicant.
4. The phytobezoar, or food-ball.

Eight cases are reported; 6 were composed of the seed of the persimmon; a quantity of celery fibers were in the seventh, and prunes and raisin skins and stems in the eighth.

With the ingestion of the barium meal, the mass is likely to be seen in the antral portion

of the stomach, depending somewhat on the size, as a clear round shadow, or light area, in the darker shadow of the barium. The appearance may suggest a large bubble or filling defect, which may be seen to rise out of the antrum and float to the surface of the meal. Pressure over the stomach may displace the mass which may rise above the level of the barium, showing as a rounded shadow in the clear air space in the fundus of the stomach.

When the bezoars are large, the meal may be seen to form a cap covering something in the stomach and to canalize along the greater or lesser curvature, between the mass and the stomach walls.

As the stomach empties, the barium streaked mass may be seen in the lower part of it.

GERIN, LIAUTARD AND CHAUVIN (MARSEILLE). Diaphragmatic hernia of the stomach from war wound. (Hernie diaphragmatique de l'estomac par blessure de guerre.) *J. de radiol. et d'electrol.*, Oct., 1923, vii, 452.

Diaphragmatic herniae following trauma, are yet considered exceptional accidents and the profession is not sufficiently informed of their relative frequency. The functional signs are absolutely insufficient to lead to a definite diagnosis of diaphragmatic hernia.

On the other hand, this condition should be considered when a wound of the diaphragm is suspected in the presence of digestive disturbance. Having this in mind, in the course of an examination of a wound of this character, leads to having the roentgenological examination made.

The author relates an unusual case of diaphragmatic hernia. In this case, a soldier was wounded on September 15, 1914. The shrapnel ball entered four fingers' width below the top of the left axillary space and was removed two fingers' breadth above the umbilicus, close to the median line.

He was treated for a slight hemorrhage, some pleural effusion, some peritoneal reaction, but presented no symptom of diaphragmatic hernia. Toward the end of the first week, when he had more substantial food, he was seized with severe epigastric pain, which became exceedingly violent, as if he were torn by a saw. This pain, of variable intensity, increased regularly after food. At the end of these painful attacks the patient complained of pain in the shoulder on the same side.

These serious digestive troubles were associated with painful sensation of burning. The appetite was partially preserved. The patient ate only milk and soup.

After food, he felt his pain continue and increase to a racking sensation and a swelling in the lower left thorax. These sensations increased for an hour and then slowly ceased unless relieved by a vomiting spell two or three hours after food. The pain resembled somewhat that of angina pectoris. A slight cough was present, but without expectoration. It was rare except during the attack.

On the roentgenoscopic screen the left base of the lung was absent and the contour of the diaphragm on the left was absolutely unmarked.

A round clear zone appeared in the gray of the left lung base resembling the gastric air pouch, but the diaphragm was elevated to a level above the horizontal track of the middle part of the heart shadow. The heart was much displaced to the right.

With the opaque meal, the bolus descended in a normal track until it reached the stomach where it spread, but singularly the pocket filled from below and not from above.

The cardia corresponds to its lowest point. The bolus descended in the esophagus alongside the length of the stomach, penetrating it at the bottom.

When the entire opaque meal was swallowed the stomach presented the appearance of two round pouches, one above the other. The inferior, the larger, entirely opaque, appeared to be in the normal position of the large end below the diaphragm. It was connected to the upper pocket by a narrow conduit clearly marked on the screen, obliquely upward to the left, which opened up suddenly to end in the second stage of this double stomach.

This upper one was entirely intra-thoracic. It is opaque in its lower fourth but is clear in its upper three-fourths which corresponds with the gastric air chamber.

This two-stage stomach, the one abdominal, the other thoracic, emptied itself with normal rapidity. When a certain part of the barium meal was evacuated, an air pocket appeared in the lower loculus while the lower part of the thoracic stomach remained opaque. Then the upper part emptied itself completely, and finally the lower part. We undoubtedly had a diaphragmatic hernia with part of the stomach in the thorax. The patient refused operation.

THOLEN, E. F. Dental impactions and their sequelae. *J. Am. M. Ass.*, 1923, lxxxi, 1664.

Eighty-four cases are reported, the majority of which had caused no pathologic changes. Forty-eight of these cases were due to infection; 23 to reflex disturbances; and 13 to post-operative complications.

Of the 48 cases, 9 resulted in osteomyelitis, periostitis and necrosis. In 1 of these there was

a temporal abscess, and another resulted in infection of the temporomandibular joint, with necrosis of the temporal bone. Death resulted.

In 35 instances there were evidences of rarefaction of bone about the teeth, and some general infection.

There were 2 cases of maxillary sinusitis from upper third molar impactions.

One case of chronic lymphadenitis of the right submaxillary group was cured by the removal of an impacted lower third molar.

The second group included only those in which the reflex symptoms were relieved by removal of the impactions.

There were 10 cases of neuralgia of one or more branches of the fifth nerve. There were 4 cases of cysts, 3 being in the mandible.

Of the 84 cases, 45 were mandibular; 32 were of the upper third molars; 6 were upper canines and 1 lower bicuspid. (One upper and one lower second molar were included in the above.)

A majority of impactions do not give rise to pathologic lesions. A minority give rise to very serious lesions.

The roentgenogram is often over-rated. Each case requires close study and weighing of all factors.

GALOB, M. A survey and interpretation of the spastic phenomena of the gastroenteric tract. *N. York. M. J.*, Nov. 21, 1923, p. 633.

The spastic phenomena are discussed under cardiospasm, gastrospasm, pylorospasm, duodenal spasm and enterospasm.

The innervation of the esophagus is derived from the vagus and from the sympathetic. The stomach is innervated by the cerebrospinal system, and the sympathetic; with the former, through the medium of the vagi, with the latter by the splanchnics through the solar plexus. The nerve supply of the intestines differs, however, as it consists mainly of nerves from the sympathetic with a few filaments from the vagus, and in addition the ganglia of Auerbach and Meissner—those of Auerbach residing between the muscular coats, and those of Meissner in the submucosa; both belonging to the sympathetic system.

In the esophagus, there are five points of constriction: (1) At the introitus, (2) at the aortic arch, (3) at the crossing of the left bronchus, (4) at hiatus esophagi and (5) at the cardiac opening. The entire epicardia, that is, the portion of the esophagus below the diaphragm, is distinctly narrower than the rest of the esophagus.

When dysphagia presents itself the question arises whether we have a neurosis or a symptom of structural pathology. If the former, we usually have as an accompanying symptom a complaint of substernal soreness. A history of long duration would complete the triad of esophageal neurosis. This, if allowed to persist, may be the precursor of structural changes.

Cardiospasm and spasm at the cardia: Cardiospasm includes hypertrophy at the cardiac sphincter with general diffuse dilatation of the esophagus. The spasm at the cardia is but a transient condition and has neither hypertrophy nor dilatation of the esophagus.

The roentgen ray shows signs of a pathological condition, from a hesitancy to a complete stoppage. The roentgenographic shadow appears as a regularly conical obstruction at or near the cardia with a secondary dilatation above it.

Cardiospasm and malignancy at the cardia can be differentiated by the roentgen ray by the following sign-complex of the latter: (1) Delayed esophageal evacuation; (2) distortion of the gas bubble; (3) distortion of the cardia, and (4) elevation of the left diaphragm. Dilatation is absent in malignancy, except for a slight dilatation above the point of constriction. Syphilis, and more particularly cardiospasm, produce a markedly dilated esophagus.

The stomach is not a static organ, passive in vocation, but a functionating dynamic apparatus sensitized to respond to stimulus from any source. Heyd summarized 100 cases of spastic phenomena of the stomach in which 20 per cent were due to organic disease of the stomach; in 40 per cent the lesion was within the abdomen, but remote from the stomach, and in the remaining 40 per cent, the pathological process resided entirely without the abdominal cavity.

The principal source lies in the vagus and sympathetic nerves.

An indispensable aid in the study of spastic troubles of the digestive tube is the roentgenological study with the opaque meal.

Roentgenographically, pylorospasm is manifested by a sharply cut off pylorus, total or partial retention of the motor meal, a deep-cutting peristalsis of the 6–8 cycle type with its activity confined to the pyloric region, a transient hour-glass contraction, and finally, occasional deep incisura at the pylorus. This last manifestation must not be confused with the normal incisura at the pars pylorica and pars cardia, which, of course, are not spastic manifestations.

KURTZAHN. Changes in the human urinary tube after contrast filling. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, xxviii, No. 4.

The author uses the tube underneath the table, dorsoventral direction of the radiation. The examination is made with the patient in the oblique position at an angle of 10 to 20°; often in addition the angle is increased to 45 to 90°. The urethra is filled as follows: A Nélaton catheter is introduced about 3 cm. into the urethra, and the urethra pressed down tightly on it with two fingers. It is then possible to inject the contrast material under pressure into the urethra with a 10 c.c. syringe, without having any of it escape along the sides, and this is of great aid in cases with narrow strictures. By the use of injections of varying temperatures, below and above body temperature, the bladder sphincter can often, but not always, be relaxed so that a part of the contrast material can enter the bladder. The author has never seen any injury with this method. Air vesicles are prevented. The author's illustrations show the normal urethra, the narrowing of its lumen, due to crushing injuries, urethral fistulae, and the so-called false passages. The author emphasizes the advantages of the roentgen examination over the use of sounds in cases of fistulae and false passages. He also considers it less injurious and less difficult than endoscopy.

FRIEDMANN, R. Diverticulitis of the large intestine. *Arcbiv. f. klin. Chir.*, 1921, xcvii, 564.

The author reports briefly a case of acute peritonitis following perforation of a diverticulum in the S romanum. The diagnosis of "acute diverticulitis" is very rarely made. The symptoms are the following: Usually the patients are men, aged forty-five to seventy years, who have a sudden attack of abdominal pain and vomiting; the fever is usually slight. The pain is always on the left side. The mortality is high, and treatment is necessarily operative.

LIEK, E. Death following roentgen burns in deep *x*-ray therapy. *Deutsche med. Wchnschr.*, 1921, No. 34, p. 999.

The author reports on roentgen-ray burns in his clinic; in 382 cases submitted to deep *x*-ray therapy, there were 12 cases of burns of the second degree and 3 of burns of the third degree. Among the latter 3 (the clinical history of which is given in detail) there was one patient who died owing to the breaking through of roentgen ulcer into the abdominal cavity, with resulting acute peritonitis. The author believes that it is necessary to take into consideration a varying sensibility to the roentgen rays in different individuals, and advises that under carefully controlled technique a test radiation of the skin should be made in each case; also that the physician himself should carefully control all the details of the technique and never entrust these to the nurse.

SANLADER. Duodenojejunal diverticula: operated case. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, xxviii, No. 5.

Reports a case in a fifty-eight-year-old patient, who since childhood had had slight gastric pains and a feeling of fulness and pressure after meals. August, 1920, after heavy lifting, he reported pain over the umbilicus, and frequent eructations, but no vomiting, after meals and after a long walk. The roentgen examination showed complete emptying of the stomach in six hours. Slightly below the navel, practically in the mid-line, a round, sharply defined shadow was shown, the size of a small coin. A new opaque meal and a second examination showed that this shadow had no relation to the stomach; it remained visible twenty-four hours after it was completely filled. At operation a sac-like protrusion was found in the lowest portion of the duodenum in the region of the duodenojejunal flexure. After separating the peritoneum above the flexure, it could be mobilized, and the protrusion smoothed out. The patient made a good recovery, and after the operation was entirely free from symptoms. The postoperative roentgen examination showed normal passage of the opaque meal through the duodenum and jejunum and no signs of the shadow of the diverticulum that had been previously visible.

SGALITZER, M., and HRYNTSCHAK, TH. Roentgen investigation of the bladder in the lateral position. *Ztschr. f. Urol.*, 1921, xv, 10.

It is possible to demonstrate the bladder roentgenologically when it is filled with a contrast material, from the side through the long pelvis. The diastolic bladder from this direction, if filled up to 50 c.c., presents the roentgenogram of an equilateral triangle, not very high and with its base toward the head. The walls of the bladder, which correspond to the sides of this, are described as the roof of the bladder, rectal bladder wall, and symphysis wall. If the bladder is more completely filled, the forward angle of the triangle spreads out and forms a fourth side, which corresponds to the other bladder wall. The internal orifice of the urethra does not form the lowest part of the bladder, but the angle of the triangle opposite the base, which the author calls the bladder sinus. The urethral orifice is above and behind the bladder sinus, in the region of the

rectal bladder wall. The change of the diastolic into the systolic form of the bladder by strangury is shown in the lateral roentgenogram by a straightening out of the anterior and posterior angles of the bladder.

POPOWSKI. Radium treatment of leucemia. *Strablentberapie*, xii, 1085.

Three cases of leucemia were favorably influenced by means of 13.95 mg. radium element, which was distributed over a surface of 9 sq. cm., and filtered with 2 mm. lead; the application being continued twenty-four hours during ten days, in the splenic region, and ten hours during ten days, over the sternum. A case of erythremia was likewise benefited by means of the same quantity of radium.

PASTEAU. Diagnosis of extra-renal radiographic shadows by pyelography. *Bull. Soc. franc. d'urol.*, 1921, ix, 5. *J. d'urol. méd. et cbir.*, xii, 29.

Four rounded shadows, arranged in the form of a rosary in the region of the kidney, were recognized as situated outside of the kidney, by means of pyelography and exposures made in different planes. The condition presumably was biliary lithiasis. No operation was performed

MARION, G. A new case of pseudo-calculus of the ureter. *J. d'urol. méd. et cbir.*, xii, 32.

A patient, forty-one years of age, presented in the *x*-ray film a shadow 6 to 7 cm. in length, and 1½ cm. in width, on the right side, at the level of the third and fourth lumbar vertebrae, touching with its mesial side the tips of the transverse process. The right kidney was removed on account of tuberculosis. The ureter did not reveal the cause of the shadow formation, but the sheath of the psoas muscle contained a chalky caseous mass which was closely connected with the psoas fibers. It was removed by means of the knife from its connections with the psoas. This mass is interpreted by the author as an old healed cold abscess in the psoas sheath. Its starting-point could not be established.

MEYER, FRITZ M. The treatment of hypertrichosis. *Deutsche med. Wchnschr.*, Feb. 2, 1923, p. 152.

No rules can be formulated as to the extent of treatment required, past experience permitting only an unconditional statement to the effect that three irradiations of the same skin area unconditionally represent the lowest minimum amount, if a true permanent epilation is to be accomplished. When the entire face is affected by hypertrichosis, a division is made into six fields: right cheek, left cheek, right chin region, left chin region, right upper lip, left upper lip. Each field receives about 250 to 350 F of a radiation filtered through 4 mm. aluminum; the measurement is made exclusively below the filter. Between the first and second radiation series, a pause of at least, six to eight weeks is required; between the second and the third, a pause of at least, eight to ten weeks should be made. In over 50 per cent of the cases, permanent epilation is accomplished after the serial radiations. In a general way, the hairs on the upper lip are apt to be especially refractory. Under observation of the necessary precautions, any hypertrichosis can be removed without incurring the risk of permanent injury. The *x*-ray method of epilation may accordingly be said to represent an enormous advance as compared to the customary painful, prolonged, and unreliable method of electrolysis.

TÄCKEL and SIPPEL. The concentration of *x*-rays; cross-fire. *München. med. Wchnschr.*, 1921, p. 604.

The problem of increasing the deep arc through secondary radiation, without markedly raising the surface dose was solved by the authors in the following way: A square water box of 7 cm. height, with a floor surface 40 × 40 cm., in which a space is left of the size of the actual radiation filter (14 × 14 and 8 × 8 cm., respectively) is placed upon the skin. In this way, a ray-collector is utilized which closely resembles the first Chaoul construction. The inner walls are lined with tin, thereby obtaining in the actual inner radiation field, the secondary radiation increase only, but not the skin dose. In addition, the customary filter of 1 mm. copper is reserved for the inner radiation field alone, while the secondary radiator is radiated through weaker filters, because the radiation in its passage through the water is automatically hardened. An increase is thus obtained of the deep dosage in the central ray-cone, without the skin dose being exceeded at any point.

MEYER, FRITZ M. *X*-ray and quartz-light treatment of some sexual diseases. *Ztschr. f. Urol.*, 1921, xv, 7.

These rays act mainly as a mere adjuvant in the treatment, for example, of painful bubos, specific leg ulcer, specific alopecia, plastic induration of the penis, prostatic hypertrophy, vesical papillomata. As the treatment of choice, radiation therapy enters into consideration for condylomata circuminata and for phagedenic soft ulcer.

AIME, PAUL. Roentgen diagnosis of chronic appendicitis. (Le radiodiagnostic dans l'appendicite chronique (avec projections). *Bull. et mem Soc. de radiol med. de Par.*, July, 1923, p. 199.

After five years' study of the appendix with the roentgen ray, a resumé of the author's studies of chronic appendicitis is offered.

He found that in all cases in which the appendix was not or had not been inflamed it could be seen on roentgen-ray examination, when not retrocecal. The visibility depended upon the filling with the opaque mixture. There was an alteration of filling and emptying which explained the divergent opinions of roentgenologists concerning the permeability of the appendix to the opaque meal.

These findings accord with what we know of the anatomy of the appendix. Because of the longitudinal and circular fibers of the musculature the food is mixed in the appendicular lumen as in the small intestine and the stomach. One sees on the screen the presence of peristaltic and vermicular movements in the organ, of which the mobility is truly surprising. Roentgenological studies by means of pictures taken in series at intervals of five minutes show on the first negative an appendix of closed ring form and on the next the same appendix in V shape with the branches largely open. The examination made five minutes later showed all of the opaque matter evacuated. In the first two pictures the peristaltic waves are admirably marked.

Chronic appendicitis. When the appendix is irritated, whether by a foreign body or an inflammation of microbic origin, the mucous membrane and musculature react. The organ becomes painful to palpation and in accordance with the degree, the seat and duration of the inflammation, spasms are produced which fix certain parts of the contents of the appendix, at times permitting it to dilate and gape. Often the peristaltic waves are obliterated and the shadow has rectilinear and parallel sides, as a whole or in part. The lumen of the canal may be filiform or very much widened.

When the appendix is not seen the most important roentgen-ray sign is based upon a painful, paracecal point accompanying the cecum in every position. There are a certain number of accessory signs which will strengthen the roentgen diagnosis of chronic appendicitis: First, the diminution of the diaphragmatic play on the right side. This diaphragmatic defense exists also for other diseases in the right abdomen. This explains the lessening of respiration on the right side and the modifications heard on auscultation of the lung of those in whom the general condition does not call to mind appendicitis. Second, one often finds gastric flatulency. The stomach is often drawn to the right until the pylorus is found in front of the cecum. Third, pain at a distance in the epigastrium or in the left iliac fossa is frequently encountered when palpation is made lying down. Palpation, made when erect, at times produce syncope.

BARTHOLOMEW, M. D. Roentgen-ray appearance in a case of congenital hydrocephalus. *J. Am. M. Ass.*, Dec. 1, 1923, p. 1879.

In this case abdominal examination having given rise to the suspicion that the head of the fetus was greatly enlarged, a roentgenogram was made which definitely showed the condition to exist, and also that there was a spina bifida. Fetal bradycardia existed in this case. It would be of interest to note if this is a usual result.

BLOODGOOD, JOSEPH C. Bone tumors, benign bone cysts due to central ostitis fibrosa of the unhealed latent type. *J. Radiol.*, Oct. 1923, iv, 345.

An immediate roentgenogram shows the disappearance of the normal picture of marrow and cancellous bone, the presence of a thin shell of cortical bone which is usually expanded, and a fracture through some portion of this thin bone shell.

A remarkable fact is that if no operation is performed and the fracture is treated as any other fracture, healing with complete ossification and restoration to normal takes place almost as rapidly as after a fracture in a normal shaft. The roentgenograms should be taken more frequently than in fractures through normal bone.

The healing of the bone cyst in which there has been only a slight fracture is usually not complete from one to four years. If accidental fracture takes place, healing is made more rapid. If the fracture is comminuted, complete ossification is as rapid as in the normal bone.

In the first cases operated upon, merely a small opening was made into the cysts. In later operations the bone shell was crushed. Complete ossification took place much more rapidly in the latter case.

These bones frequently return to normal after a few years. When the roentgenogram shows bone cyst and slow or imperfect ossification, operation is called for.

CANDY, T. I. Radiography of the fetus in utero. *Arch. Radiol. & Electroth.*, Oct., 1923, xxviii, 146.

The difficulties in this work are as follows: 1. The thickness of the maternal soft

tissue to be penetrated, causing scattering of the beam and blurring of definition.

2. The cartilaginous nature of the fetal skeleton giving poor contrast in such a thick mass of soft tissue.

3. The presence of the amniotic fluid increasing the scattering of the beam of roentgen rays.

4. Fetal movements.

The first three can be overcome by the Potter-Bucky diaphragm. The patient should lie face down on the Potter-Bucky diaphragm with the trochanters about 1 in. or so above the lower edge of the film in the cassette. The chest should be well raised on pillows with sand bags upon the backs of the thighs.

The anticathode of the overhead tube should be centered over the third lumbar vertebra at a distance of 30 in. from a 15 by 12 duplitized film with double intensifying screens. The patient is asked to hold her breath and at the same time to press down the abdomen firmly into the Potter-Bucky diaphragm. The assistant immediately applies firm, but not vigorous, compression with the compression band, and the exposure is made usually for about five seconds, using 25 to 30 ma. with a spark gap of 5½ in.

Overexposure must be avoided; brilliancy and contrast are essential in roentgenography of the fetus in utero. The best results are to be obtained by the use of standard developing solution used at a standard temperature for a standard length of time.

The roentgenogram will give positive evidence of the position of the fetus, together with evidence of its position in the mother's tissues.

CUNNINGHAM, JOHN H., GRAVES, ROGER C., and DAVIS, TENNY L. An antiseptic pyelographic medium. *J. Urol.*, Sept., 1923, x, 255.

It was found, after consideration of all possible antiseptics in connection with a pyelographic solution, that 1:3000 mercuric iodide in 12 per cent sodium iodide is the most satisfactory. Sodium mercuric iodide of this strength has a phenol coefficient of 0.033. In other words, it is comparable, on this basis, to 3 to 4 per cent carbolic acid. Used in equal amounts with a colon bacillus infected urine, it destroyed bacterial growth in two and one-half minutes. The solution retained in the mouth for a considerable period produces a salty paste, but no irritation of the buccal mucosa. Introduced into the circulation of a rabbit, it produced no significant change in the condition of the animal so far as heart, blood pressure and respiration were concerned.

Of course the final test of this solution rests in its clinical application. It is employed routinely in our clinic and thus far we have observed no immediate or subsequent ill effects or discomfort, following its use in either the bladder or the renal pelvis, even in the presence of active inflammation. The addition of the antiseptic sacrifices in no degree the value of the medium from the standpoint of the roentgen-ray density.

The use of 1:3000 mercuric iodide in 12 per cent sodium iodide solution, as an antiseptic pyelographic medium is recommended for two important reasons: (1) It reduces to a minimum the risk of introducing infection; (2) it provides some degree of positive benefit, apart from diagnosis, in cases in which infection already exists.

The solution is prepared by dissolving 1 gm. of mercuric iodide in 3000 c.c. of 12 per cent sodium iodide. The latter is made with chemically pure sodium iodide and distilled water. The final solution does not need to be boiled.

FISCHER, A. On a new roentgen diagnostic method of the large intestine. Combination of contrast enema and air insufflation. *Klin. Wchnschr.*, 1923, ii, 1595.

The author introduces a contrast medium-barium sulphate bolus suspension as far up as the cecum. He then removes it entirely, or parts of it. He does not consider the removal necessary when colon ascendens and descendens are to be examined, but for the sigmoid loop and the transverse colon it is better. Air is then introduced and the contrast medium adhering to the intestinal walls renders the outlines distinct.

LABORDERIE, J. (DE SARLAT.) Roentgenological study of tracheobronchial adenopathy. (L'adenopathie tracheo-bronchique. Etude radiologique). *Rev. gén. de clin. et de thérap.*, Oct. 13, 1923, xxxvii, 668–671.

Tracheobronchial adenopathy is a more frequent disease in infantile pathology than it is thought to be, and its early diagnosis, though difficult, can be made.

This affection is the starting point of a large number of cases of tuberculosis in the adolescent and the adult.

Treated from the beginning, these tracheobronchial adenopathies are arrested in their development and do not become favorable ground for the growth of bacilli. On the other hand, when the state of resistance is lowered by overfatigue, by excess or by infectious disease, these relight and an incurable tubercu-

losis is begun. Roentgen-ray diagnosis is of great value in these cases.

It frequently happens that the child is pale, in bad condition, nervous, with capricious appetite, and the mother often finds that when he plays he becomes slightly breathless, with a hard, dry, irritating cough at night.

Inspection often reveals an increase in size of the veins of the neck, which are rendered very apparent. Auscultation and percussion sounds are changed. The roentgen-ray examination systematically practiced will remove all doubt.

This may be done in two ways: (1) by the screen; (2) by the roentgen-ray plate or film.

The first permits the examination of the peri-hilum glands. The second permits the detailed study from a permanent record.

A knowledge of the normal hilum is required to interpret properly these shadows.

In an infant attacked by tracheobronchial adenopathy, hypertrophied, softened, caseated or calcified glands are formed.

The shadow of the hilum is accentuated and the superior and lower bronchial trunks appear larger, with some thickened points.

At a later stage, the ganglia appear as isolated shadows, more or less lengthened, with rounded, softened contour.

The isolated ganglia present a peripheral irradiation which makes this resemble a spider web or a star.

In other cases, the ganglia have an opacity like a metallic foreign body.

These latter are rare in children and are observed only in the last stage in which the ganglia are grouped into a more or less homogeneous group or groups.

The seat of these ganglia is at the level of the hilum, but they may also be found down to the level of the diaphragm; and in the angle of the shadow of the heart and the great vessels near the vertebral column.

An early diagnosis is important and capital importance should be attached to the roentgen-ray examination.

A few treatments suffice to cause this cough and dyspnea to disappear, and to completely cure this affection.

LARRABEE, W. S. The value of *x*-ray examination in pulmonary disease. *Southwest Med.*, Oct., 1923, vii, 376.

The report from roentgen-ray examinations in some pulmonary cases is difficult to believe, particularly in supposed negative cases when marked evidence of fibrous tissue increase, with small cavities, calcified glands, etc., is present. The careful diagnostician is often in doubt if such evidence is to be trusted, but with experience, knowing the normal appearance, he learns that pathological changes can be detected with positiveness, and that the roentgen ray is of distinct value to him as an aid to diagnosis of the lungs.

Every screen examination should be supplemented by stereoscopic films. These supplement each other and the examination is incomplete unless both are used. No plate will tell the diagnostician of the action and excursion of the diaphragm, and the aeration of the apices.

The upright position is necessary only when effusion is suspected. The location and extent of lesions may be determined by the roentgen ray with a certainty and rapidity beyond the power of physical examination to approach. The film remains a permanent record for reference or comparison of cases. This method does not displace physical examination but must be considered with it. The clinical history should always go with these findings.

Many cases of tuberculosis that are diagnosed as the first stages are found by this method to be advanced. When the peribronchial shadows have a woolly outline and one apex fails to light up as well as the other, when one side is lighter than the other or when there is limitation of movement of the diaphragm, then there is reason to suspect beginning tuberculosis.

The courts have decided that the roentgenogram belongs to and is a part of the records used by the roentgenologist in arriving at his diagnosis. The physician who sends his patient in for an examination should have a detailed report of the findings and whatever additional information is seen to bear upon the case. A roentgen-ray examination is a medical consultation and should be so regarded by both patient and physician.

LEDOUX-LEBARD, R. Roentgenological study of the appendix. (L'etude radiologique de l'appendice). *Bull. et mem. Soc. de radiol. med. de Par.*, July, 1923, p. 197.

It must be recalled that it was in France that the possibility of demonstrating by roentgenogram, the filling of the appendix with an opaque medium, was made known. The thesis of Gourcerol reviews very completely these first observations of the first roentgenologists (Desternes, Baudon, Aubourg, etc.).

The Americans have striven with success and have shown very fine and numerous roentgenograms. (Case, Cole, Carman, George, Leonard etc.) They have fixed the technique of the examination of the appendix. Certain of them have stated that it is not always possible to show this organ unless a lesion is present.

The visibility depends perhaps upon the opaque mixture used, barium mixture being better than the carbonate of bismuth. The more often the examination is made between the fourth and the thirty-sixth hour the better the chance to get the image of the appendix. It was seen most frequently by the writer between the seventh and tenth hour and these between the twenty-second and the thirtieth hour.

If the appendix remains for a long time the only part of the digestive tube retaining the opaque mixture, it would appear to be a pathologic retention.

In the emptying and filling of the appendix it appears to be a mobility within itself rather than the application of exterior force.

LENNOX, W. G. A study of the basal and nitrogenous metabolism in a case of acute leukemia during roentgen-ray treatment. *Arch. Int. Med.*, Nov. 15, 1923, xxxii, 705.

The patient in this case of leucemia was studied for fifty days, during which time the diet was weighed and prepared by the hospital dietitian, supplying 1.4 gm. of nitrogen per kilogram of body weight, 92 gm. of fat (on the thirteenth day increased to 116 gm., and 240 gm. of carbohydrate). This yielded about 2,050 calories, which was about 10 per cent above the patient's basal requirement.

A chart is given of the leucocyte count, morning and evening temperature, basal metabolism, the nitrogen intake and output, the fat and carbohydrate calories.

Inspection of the chart reveals that the patient maintained a positive nitrogen balance of a gram or two on a normal intake of about 10 gm. a day. This showed a very low leucocyte count.

The nitrogen balance was little affected by roentgen-ray exposure of the superficial lymph-nodes. Radiation of the thoracic glands and the spleen, on the other hand, produced a marked increase in urinary nitrogen.

Leucocyte count and nitrogen balance were reciprocal factors, a rising leucocyte count accompanying nitrogen retention, and a falling count, nitrogen loss.

Leucocyte count, temperature and basal metabolism moved together. The leucocyte count was the most mobile. The metabolism seemed a better indicator of the severity of the process than the leucocyte count.

LEPENNETIER, FRANCOIS. X-rays, high frequency, and associated electrolysis in the treatment of the sequelae of cervical tuberculous adenitis. (Les rayons x, la haute frequence et l'electrolyse associes dans le traitement des sequelles de l'adenite cervicale tuberculeuse). *J. de radiol. et d'electrol.*, Sept., 1923, vii, 393.

The apparatus differs in no way from the usual form. For roentgenotherapy: a No. 2 Gaiffe table with a Chabaud ampoule or a standard Coolidge tube according to the case. For the high frequency d'Arsonval-Gaiffe connected with an Oudin resonator; the application is made with a MacIntyre electrode or a flat or rough electrode. Electrolysis is done with platinum needles containing a small amount of iridium; the current is supplied by a storage battery. Zinc electrode was used in keloids in the same laboratory by Dr. Bonte, but not by them.

Haret and Dariaux reported on this matter in the Radiological Congress of Anvers in 1920.

An opened Monoganglional adenitis or one with a recent fistula is amenable to the action of the roentgen-ray, and of high frequency: 3 to 4 mm. of aluminum overlapping half a centimeter all around, the neighboring skin being protected by lead 2 mm. thick. J. Belot counsels doubling this by a second of the same dimension within a leaf of opaque caoutchouc. This last is intended to protect the skin from the secondary radiation from the lead. This protection is reinforced by the employment of a leaf of board placed between the filters or between the localizer and the skin. The high frequency is applied with the flat narrow brush electrode or with the condensed electrode. In the first case the electrode is held by the operator at such a distance from the skin that the special hum of the continuous discharge is heard and one sees a violet light and smells the characteristic odor of ozone. These high-frequency seances should last from ten to fifteen minutes so as to cause a slight erythema of the skin. This is repeated three times a week.